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BOTANY.—*New species and new names of grasses from Texas.*[1]

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In the course of the preparation of a manual of grasses of the United States it has been found necessary to describe several new species and to transfer a few names. The following descriptions and transfers concern grasses found in Texas.

Bromus anomalus var. **lanatipes** (Shear) Hitchc.

Bromus porteri lanatipes Shear, U. S. Dept. Agr. Div. Agrost. Bull. 23: 37. 1900.

Eragrostis arida Hitchc., sp. nov.

Annua; culmi tenerae, basi ramosi, 20–40 cm. alti; laminae planae, longe acuminatae, 4–8 cm. longae, 1–2 mm. latae; panicula erecta, patula, 8–15 cm. longa, ramis in axillis glabris vel paullum pilosis, solitariis vel inferioribus binis; spiculae oblongae vel lineares, stramineae, 8–15-flores, 5–10 mm. longae, 1.5–2 mm. latae, pedicellis patulis flexuosis lateralibus 2–3 mm. longis; glumae acutae, prima angusta 1 mm. longa, secunda paullum longior et latior; lemmata 1.6–1.8 mm. longa, acutiuscula; palea persistens.

Annual; culms branching at base, slender, erect or somewhat decumbent at base, 20 to 40 cm. tall; sheaths glabrous, pilose at the summit, the hairs in a dense line part way along the collar; ligule a dense line of hairs about 0.5 mm. long; blades flat or sometimes folded or loosely involute, glabrous, tapering to a fine point, mostly 4 to 8 cm. long, 1 to 2 mm. wide; panicle one-third to half the entire height of the plant, erect, open, the branches, branchlets, and pedicels spreading, the axils glabrous or the lower sparsely pilose, the branches solitary, rather distant or the lower in pairs; spikelets oblong to linear, stramineous or drab, mostly 8 to 15-flowered, 5 to 10 mm. long, 1.5 to 2 mm. wide, somewhat compressed, the pedicels flexuous, the lateral 2 to 3 mm. long; glumes acute, the first narrow, scarcely 1 mm. long, the second a little longer and wider; lemmas 1.6 to 1.8 mm. long, acutish; palea scarcely as long as the lemma, persistent; grain 1 mm. long.

Type in the U. S. National Herbarium, no. 905937, collected on prairie at Del Rio, Texas, September 14, 1915, by A. S. Hitchcock (no. 13650).

This species has been confused with *Eragrostis suaveolens* Becker, *E.*

[1] Received August 10, 1933.

mexicana (Lag.) Link, *E. pilosa* (L.) Beauv., and *E. limbata* Fourn. It differs from *E. suaveolens* in the smaller size, the lack of glands on the sheaths, and the slightly smaller spikelets; from *E. mexicana* in the smaller and more slender stramineous spikelets; from *E. pilosa* in the larger spikelets; from *E. limbata*, which is confined to Mexico, in its larger panicles, longer stramineous spikelets, and more acute lemmas.

Dry soil, Texas to Arizona and central Mexico.

TEXAS: Lubbock, *Whitehouse* 7509; Amarillo, *Hitchcock* 16205; Edinburg, *Swallen* 1081; Del Rio, *Hitchcock* 13650; Lyford, *Hitchcock* in 1904; New Braunfels, *Hitchcock* 5196.

ARIZONA: South of Bisbee, *Mearns* 1028, 1071; Baboquivari Mountains, *Gilman* A 20.

NEW MEXICO: Carlsbad, *Hitchcock* 13487.

SONORA: South of Nogales, *Griffiths* 6793. Hermosillo, *Hitchcock* 3593.

CHIHUAHUA: Candelaria, *Stearns* 261.

DURANGO: Tlahualilo, *Pittier* 476.

NAYARIT: Acaponeta, *Rose* 14321.

Eragrostis intermedia Hitchc., sp. nov.

Perennis; culmi erecti, caespitosi, 40–80 cm. alti; vaginae glabrae, apice valde pilosae; laminae planae vel plus minusve involutae, plerumque glabrae; 10–20 (–30) cm. longae, 1–3 mm. latae; panicula erecta, patula vel diffusa, 15–35 cm. longa, in axillis pilosa, ramis patulis, tenuibus, solitariis, inferioribus duobus vel tribus; spiculae 3–9-flores, 3–10 mm. longae, pedicellis flexuosis, 5–15 mm. longis; glumae acutae, prima 1–1.2 mm. longa, secunda 1.2–1.4 mm. longa; lemmata turgida, obscure nervata, 1.8–2 mm. longa; palea persistens.

Perennial; culms erect, tufted, mostly 40–80 cm. tall; sometimes taller; sheaths glabrous or the lowermost sparsely pilose, conspicuously pilose at the throat, the hairs extending in a line across the collar; ligule a dense line of hairs less than 0.5 mm. long; blades flat or more or less involute, especially those of the innovations, pilose on the upper surface near the base, otherwise glabrous or sometimes with a few scattering hairs, scabrous toward the fine involute point, 10 to 25 cm. long, sometimes as much as 30 cm., 1 to 4 mm. wide; panicle erect, open, often diffuse, 15 to 35 cm. long, at maturity usually about two-thirds as wide, pilose in the axils, sometimes sparsely so, rarely glabrous, the branches slender but rather stiff, solitary and somewhat distant or the lower in pairs or verticils, all spreading, often widely or horizontally, the branchlets and pedicels ascending or spreading; spikelets 3 to 8, rarely 9-flowered, 3 to 9, rarely 10 mm. long, 1 to 1.5 mm. wide, grayish or brownish green, the pedicels somewhat flexuous, minutely scabrous, 1 to 3 times as long as the spikelet; glumes acute, the first 1 to 1.2 mm. long, the second 1.2 to 1.4 mm. long; lemmas turgid, obscurely nerved, 1.8 to 2 mm. long, usually bronze-tipped, not hyaline-margined; palea about as long as the lemma, persistent, minutely scabrous on the keels; caryopsis oblong, about 0.7 mm. long.

Type in the U. S. National Herbarium, no. 1535749 collected in moist place in gravel pit near San Antonio, Texas, July 3, 1910, by A. S. Hitchcock (no. 5491).

The following specimens, previously referred to *Eragrostis lugens* Nees, are representative of the species:

MISSOURI: Sheffield, *Bush* 9222; Redings Mill, *Bush* 5064.

GEORGIA: Athens, *Harper* 32, *Weatherwax* 11; Camelle, *Tracy* 3729.

LOUISIANA: Lake Charles, *Chase* 6113; Avery Island, *Hitchcock* 19863; Natchitoches, *Ball* 152.

ARKANSAS: Fayetteville, *Hitchcock* 16076.

OKLAHOMA: Wichita Mountains, *Swallen* 1004, 1025, *Rose* 112; Sapulpa, *Bush* 810; Stillwater, *Hitchcock* 16156.

TEXAS: *Bailey* 742; *Bogush* 1318; *Bush* 304; *Drummond* 328; *Fisher* 2059; *Griffiths* 6290; *Hall* 788; *Havard* 33; *Heller* 1745; *Hitchcock* 5167, 5219, 5268, 5287, 5294, 5371, 5491, 13611, 13645, 13646; *Moore & Steyermark* 3176; *Mulford* 99; *Nealley* 499; *E. J. Palmer* 31857, 32138a; *Plank* 93, 95; *Reverchon* 1125, 1125A; *Silveus* 81, 141, 368; *Standley* 40553; *Swallen* 976, 1103, 1540, 1799, 1863; *Tharp* 5024, 5163; *Tracy* 7918, 7926, 7928, 8235, 8876.

NEW MEXICO: *Blumer* 184; *Greene* 402; *Hitchcock* 3800, 13535; *Mearns* 680, 2097; *Metcalfe* 1329; *Rose & Fitch* 1764, 17,670; *Wright* 2048, 2050.

ARIZONA: *Griffiths* 1843, 1853, 3433, 4857, 5948, 6067, 6969, 7141; *Griffiths & Thornber* 58; *Hitchcock* 3688, 3709, 3725, 3726, 13271; *Jones* 4226; *Lemmon* 338, 2906; *Mearns* 1166, 1910; *Purpus* 8280; *Toumey* 735, 736; *Wilcox* 159.

This species extends into northern Mexico.

Eragrostis swalleni Hitchc., sp. nov.

Perennis; culmi dense caespitosi erecti, 20–50 cm. alti; infra nodo glanduloso-cincti; vaginae glabrae, apice paullum pilosae; laminae involutae, glabrae, 10–30 cm. longae; panicula erecta, patula, 10–20 cm. longa, in axillis glabra, ramis ascendentibus vel patulis, glabris, flexuosis; spiculae oblongo-lineares, stramineae vel cano-virides, 7–10 mm. longae, 8–14-flores, pedicellis supra medium glanduloso-cinctis; lemmata imbricata, adpressa, 2 mm. longa; palea persistens.

Perennial; culms in dense tufts, erect, 20 to 50 cm. tall, an obscure glandular band below the nodes; sheaths glabrous, sparingly pilose at the throat; ligule a dense line of hairs about 0.5 mm. long; blades firm, arching-recurved, mostly involute, glabrous, the lower sometimes with a few long hairs, 1 to 1.5 mm. thick when rolled (1 to 2 mm. wide when flat), 10 to 30 cm. long, the uppermost not greatly reduced; panicle erect, open, 10 to 20 cm. long, mostly short-exserted, the axis and branches glabrous, the branches ascending to spreading, stiffly flexuous, rather few-flowered, glabrous in the axils; spikelets oblong to linear, stramineous or grayish green, 7 to 10 mm. (rarely to 12 mm.) long, about 2 mm. wide, mostly 8 to 14-flowered, the stiff slender pedicels bearing a glandular band or spot above the middle; glumes acutish, rather broad, the first 1.2 mm. long, the second 1.5 to 1.8 mm. long; lemmas rather closely imbricate, appressed, acutish about 2 mm. long; palea about as long as the lemma, persistent, minutely scabrous on the keels; grain nearly smooth, somewhat narrowed toward the summit, 1 mm. long.

Type in the U. S. National Herbarium, no. 1,535,332, collected on sandy prairie at Riviera, Texas, June 8, 1931, by Jason R. Swallen (no. 1847).

Four other specimens were collected on sandy prairie at Sarita, *Hitchcock* in 1904 (August 7), *Hitchcock* 5449 and 5489 (June 27, 1910), and *Swallen* 1517 (April 17, 1931).

The species is allied to *Eragrostis erosa* Scribn., but is distinguished by the dense bunches, lower culm, smaller panicles, and especially the glandular band on the pedicels.

Vaseyochloa Hitchc., gen. nov.

Spiculae subteretes, multiflorae; lemmata imbricata 7–9-nervia, apice integra, dorso inferiore marginibusque pubescentia; panicula angusta; planta perennis, foliis elongatis.

Spikelets subterete or slightly compressed, several-flowered, the rachilla disarticulating above the glumes and between the florets, the joints very short; glumes rather firm, unequal, much shorter than the lemmas, the first 3 to 5-nerved, the second 7 to 9-nerved; lemmas rounded on the back, firm, closely imbricate, 7 to 9-nerved, broad, narrowed to an obtuse entire apex, and with a stipelike hairy callus, pubescent on the lower part of the back and margins; palea shorter than the lemma, splitting at maturity, the arcuate keels strongly wing-margined; caryopsis concavo-convex, oval, black, the base of the styles persistent as a 2-toothed crown. Slender perennial with elongate blades and narrow panicles.

Type species, *Melica multinervosa* Vasey.

Vaseyochloa multinervosa (Vasey) Hitchc.

Melica multinervosa Vasey, Bot. Gaz. **16**: 235. 1891.
Distichlis multinervosa (Vasey) Piper, Proc. Biol. Soc. Washington **18**: 147. 1905.
Triodia multinervosa (Vasey) Hitchc. Proc. Biol. Soc. Washington **41**: 159. 1928.

Triodia buckleyana (L. H. Dewey) Vasey

Sieglingia buckleyana L. H. Dewey, Contr. U. S. Nat. Herb. **2**: 540. 1894.
Triodia buckleyana Vasey; Dewey, Contr. U. S. Nat. Herb. **2**: 540. 1894, as synonym of *Sieglingia buckleyana* L. H. Dewey.

The nomenclature here illustrates several cases in which names first recorded as synonyms are later accepted as valid. The original specific name *buckleyana* (under *Sieglingia*) must be used under *Triodia*, but since citation as a synonym is not valid publication I publish the name here in order to validate it. I have chosen to give Vasey as the author of the combination, but the date of effective publication is that of the present paper. Had I chosen to omit Vasey as the author, in making the transfer, the combination as credited to me would have been legitimate.

Elymus virginicus var. **australis** (Scribn. & Ball) Hitchc.

Elymus australis Scribn. & Ball, U. S. Dept. Agr. Div. Agrost. Bull. **24**: 46. *f. 20.* 1901.

Hordeum pusillum var. **pubens** Hitchc., var. nov.

Spiculae pubescentes.

Glumes and lemmas pubescent; spikes usually somewhat broader; dilated glumes wider. In some cases the pubescence is rather scant.

Type in the U. S. National Herbarium, no. 270730, collected at La Verkin, Utah, by Marcus E. Jones (5196W.). The following specimens belong to this variety:

TEXAS: Arlington, *Allen* 20; San Antonio, *Havard* 5.
UTAH: Springdale, *Jones* 5253.
ARIZONA: Santa Rosa to Casa Grande, *Griffiths* 4043.

Sphenopholis longiflora (Vasey) Hitchc.

Eatonia pennsylvanica var. *longiflora* Vasey; L. H. Dewey, Contr. U. S. Nat. Herb. **2**: 544. 1894.

Muhlenbergia utilis (Torr.) Hitchc.

Vilfa utilis Torr. U. S. Rep. Expl. Miss. Pacif. **5**[2]: 365. 1857.

Allied to *M. repens* (Presl) Hitchc., to which it has been referred as a synonym. It is a more delicate species with finer leaves and smaller spikelets, and is confined to moist places.

Muhlenbergia fournieriana Hitchc.

Epicampes berlandieri Fourn. Mex. Pl. **2**: 89. 1886. Not *Muhlenbergia berlandieri* Trin. 1841.

Muhlenbergia rigens (Benth.) Hitchc.

Epicampes rigens Benth. Journ. Linn. Soc. Bot. **19**: 88. 1881.

Sporobolus microspermus (Lag.) Hitchc.

Milium microspermum Lag. Gen. & Sp. Nov. 2. 1816.
Sporobolus confusus Vasey, Bull. Torrey Club **15**: 293. 1888.

Piptochaetium fimbriatum (H.B.K.) Hitchc.

Stipa fimbriata H.B.K. Nov. Gen. & Sp. **1**: 126. 1815.
Oryzopsis fimbriata Hemsl. Biol. Centr. Amer. Bot. **3**: 538. 1885.

Aristida ternipes var. **minor** (Vasey) Hitchc.

Aristida schiediana var. *minor* Vasey, Bull. Torrey Club **13**: 28. 1886.
Aristida divergens Vasey, Contr. U. S. Nat. Herb. **3**: 48. 1892.

Bouteloua rigidiseta (Steud.) Hitchc.

Aegopogon rigidisetus Steud. Syn. Pl. Glum. **1**: 146. 1854.
Bouteloua texana S. Wats. Proc. Amer. Acad. **18**: 196. 1883.

The type of *Aegopogon rigidisetus* was collected in Texas by Drummond. Steudel gives no number, but it may be no. 340 or no. 374. Both numbers

are in the Edinburgh Herbarium and no. 340 is in the Trinius Herbarium. The specimens cited by Watson under *B. texana* are *Berlandier* 1535, *Drummond* 340, 374, *Lindheimer* 732, *Wright* 752. Griffiths, in his revision of *Bouteloua*, designates the first cited specimen (*Berlandier* 1535) as the type. This is in the Gray Herbarium. Watson states that his *B. texana* "appears to be the *Aegopogon rigidisetus* of Steudel."

Bouteloua gracilis var. **stricta** (Vasey) Hitchc.

Bouteloua stricta Vasey, Bull. Torrey Club 15: 49. 1888.

The type was collected in western Texas by Nealley. The spikes are 4 to 6, usually ascending or appressed.

Zizania texana Hitchc., sp. nov.

Perennis; culmi a basi longe decumbentes; laminae elongatae, 3–13 mm. latae; panicula angusta, 20–30 cm. longa, ramis inferioribus ascendentibus, 5–10 cm. longis; spiculae masculae 7–8 mm. longae, 1.5 mm. latae; spiculae foeminae circa 1 cm. longae, 1 mm. latae, arista 1–2 cm. longa.

Plant perennial; culms comparatively slender, long-decumbent and rooting at base, 1 to 1.5 meters long (or even as much as 3 meters), the lower part with leaves often floating on the water, the upper part erect; sheaths striate; ligule membranaceous, acute, 5–10 mm. long; blades elongate, flat, glabrous, slightly scabrous on the margins, 3 to 13 mm. wide (mostly less than 1 cm.), the uppermost blade 15 to 20 cm. long; panicle erect, narrow, mostly 20 to 30 cm. long, the lower (staminate) branches ascending or somewhat spreading, slender, 5 to 10 cm. long in about 3 whorls, woolly-villous at the base; upper branches (pistillate) appressed; staminate spikelets 7 to 8 mm. long, about 1.5 mm. wide, abruptly acute; pistillate spikelets about 1 cm. long, 1 mm. wide, terete, sulcate, scabrous on the ridges, gradually narrowed into a very scabrous, somewhat flexuous awn 1 to 2 cm. long.

Type specimen in the U. S. National Herbarium, no. 1,537,174, collected at San Marcos, Texas, in running water, April 1932, by W. A. Silveus (no. 518).

This species was also collected at San Marcos by Nealley in August 1892. Mr. Silveus writes concerning this grass:

"I found in the San Marcos River at San Marcos, Texas, a great amount of this grass growing in water 1–6 feet deep, often in swiftly flowing currents, the culms and long blades mostly floating on or some distance under the surface of the water. The culms, sometimes 10 feet long, finally bend upwards at or near the surface of the water, the erect or ascending portion bearing an unusual and beautiful panicle 1–3 feet above the water. The branching culms, often geniculate at the base, root at the nodes, especially those near the base and at the bend near the surface of the water. It is claimed that cattle have been seen sticking their heads deep in the water to get this grass. Did not find any of it growing away from the water."

Trichachne hitchcockii (Chase) Chase.

Valota hitchcockii Chase, Proc. Biol. Soc. Washington 19: 188. 1906.

Trichachne californica (Benth.) Chase.

Panicum californicum Benth. Bot. Voy. Sulph. 55. 1840.
Panicum saccharatum Buckl. Prel. Rep. Geol. Agr. Surv. Tex. App. 2. 1866.
Trichachne saccharata (Buckl.) Nash in Small, Fl. Southeast. U. S. 83. 1903.
Valota saccharata (Buckl.) Chase, Proc. Biol. Soc. Washington 19: 188. 1906.

The type specimen of *Panicum californicum* from Magdalena Bay, Lower California, was examined in the Kew Herbarium. Under the International Rules *Valota* was not effectively published by Adanson, the few characters in his table being inadequate. *Trichachne* Nees thus becomes the valid name.

Digitaria runyoni Hitchc., sp. nov.

Perennis; culmi ascendentes a basi longe decumbentes, 40–70 cm. alti; vaginae superiores glabrae, inferiores villosae; laminae planae, 3–6 mm. latae, superiores glabrae, inferiores dense villosae; racemi 5–10, suberecti, 7–12 cm. longi, rachi trigona; spiculae pallidae, imbricatae, anguste lanceolatae, acutae, 3.5–4 mm. longae; gluma prima minuta vel obsoleta; gluma secunda et lemma sterile aequalia, dense villosae; lemma fertile acuminatum quam spicula paullo brevius, maturitate pallidum.

Perennial; culms spreading at base, sometimes long-decumbent and rooting, 40 to 70 cm. tall, leafy at base; upper sheaths glabrous, the lower pilose, the lowermost densely villous; ligule 1 to 2 mm. long; blades flat, the lower densely velvety-villous, the upper sparingly pilose or glabrous, mostly less than 10 cm. long, 3 to 6 mm. wide, the uppermost reduced; racemes 5 to 10 on an axis 1 to 4 cm. long, mostly suberect, 7 to 12 cm. long, pale, the rachis flat-triangular, the margin very narrow, scabrous; spikelets in pairs, imbricate, narrowly lanceolate, acute, 3.5 to 4 mm. long, the longer pedicel 2 to 3 mm. long; first glume minute or obsolete; second glume and sterile lemma equal, from sparsely to densely villous on the internerves, the hairs purplish, sometimes nearly 1 mm. long, the lemma glabrous on the middle internerves, 5-nerved, the glume 3-nerved; fertile lemma acuminate, usually a little shorter than the spikelet, pale at maturity.

Type in the U. S. National Herbarium, no. 1,468,080, collected on sand flats near the coast at the mouth of the Rio Grande, near Brownsville, Texas, April 21, 1929, by Robert Runyon (no. 188).

Collected also on sand dunes 15 miles south of Corpus Christi by W. A. Silveus (no. 356), on sandy prairie, 10 miles south of Corpus Christi by J. R. Swallen (no. 1829½), and in sand at Copano Bay (east side) by B. C. Tharp (no. 7908).

Eriochloa gracilis (Fourn.) Hitchc.

Helopus gracilis Fourn. Mex. Pl. 2: 13. 1886.

This species has been referred to *Eriochloa acuminata* (Presl) Kunth of Mexico. A weed in fields, western Texas to southern California, south through the highlands of Mexico. Originally described from Oaxaca, Mexico.

Eriochloa gracilis var. **minor** (Vasey) Hitchc.

Eriochloa punctata var. *minor* Vasey, Contr. U. S. Nat. Herb. 3: 21. 1892. Texas to Arizona.

Andropogon divergens (Hack.) Anderss.; Hitchc.

Andropogon scoparius subsp. *maritimus* var. *divergens* Hack. in DC. Monogr. Phan. 6: 385. 1889.

Andropogon divergens Anderss.; Hack. loc. cit. as synonym of *A. scoparius* subsp. *maritimus* var. *divergens*, "*A. divergens* Anderss. in sched. h. berol."

The locality given by Hackel is, "Texas (leg.?; vidi in h. berol.)." The type in the Berlin Herbarium is labeled "*Andropogon divergens* Anderss. [in Andersson's script]. Texas. dd. Lindley."

This case is like that of *Triodia buckleyana*, discussed above.

Andropogon virginicus var. **hirsutior** (Hack.) Hitchc.

Andropogon macrourus var. *hirsutior* Hack. in DC. Monogr. Phan. 6: 409. 1889.

BOTANY.—*New grasses from the United States, Mexico, and Central America.*[1] JASON R. SWALLEN, Bureau of Plant Industry.

In the course of identifying several collections of grasses, eight species were found to be new. The first is a *Stipa* collected by Hans Wilkens in the Guadalupe Mountains, New Mexico. Two species, one of which is a very distinct *Echinolaena*, the second of this genus, were found by Paul Weatherwax in Guatemala. A new *Axonopus* and a new *Mesosetum* were discovered by H. H. Bartlett in British Honduras.[2] The *Mesosetum* was originally described as *Peniculus angustifolius* Swallen. In earlier collections, there were three other new species of *Axonopus*, one found at Vera Cruz, Mexico, by A. S. Hitchcock, one at Morelia, Mexico, by Brother G. Arsène, and the last at Izabal, Guatemala, by S. F. Blake.

Stipa curvifolia Swallen, sp. nov.

Culmi dense caespitosi, erecti, 33 cm. alti; folia basi aggregata; vaginae scaberulae, inferiores dense pubescentes; laminae involutae, maximae 18 mm. longae, scaberulae vel glabrae, curvatae; panicula 7–8 cm. longa, densa, ramis appressis; glumae subaequales, acuminatae, 10 mm. longae, 3-nerves, marginibus hyalinis; lemma 5.5 mm. longum, fuscum, pilosum, callo pungenti dense piloso; arista 22–25 mm. longa, 1-geniculata, infra geniculum plumosa.

[1] Received August 14, 1933.

[2] These two grasses were collected on an expedition of the Herbarium and the Museum of Zoology, University of Michigan, collaborating with the Department of Historical Research, Carnegie Institution of Washington, in a biological survey of the Maya area.

Culms densely tufted, erect, 33 cm. tall; leaves clustered toward the base, the sheaths scaberulous, the lowermost densely pubescent, the blades firm, involute, as much as 18 mm. long, becoming curled with age, scaberulous or nearly smooth; panicles 7–8 cm. long, dense, the branches short and appressed; glumes subequal, acuminate, 3-nerved, 10 mm. long, the first broader than the second, the tips and margins hyaline; lemma 5.5 mm. long, light brown, evenly pilose with white hairs, the callus sharp-pointed, densely hairy; awn once or obscurely twice-geniculate, 22–25 mm. long, twisted and densely plumose below the bend, the terminal segment straight, scabrous.

Type in the U. S. National Herbarium, no. 1,538,063, collected in crevices of limestone cliff near mouth of North Fork of Rocky Arroyo, Eddy Co., Guadalupe Mountains, New Mexico, April 29, 1932, by Hans Wilkens (no. 1660).

This species is probably most closely allied to *S. occidentalis* Thurb., which differs in having straight blades, panicles 10–20 cm. long, lemmas 7 mm. long, and twice-geniculate awns, 3–4 cm. long.

Echinolaena gracilis Swallen, sp. nov.

Culmi graciles, ramosi, pilosi, 75–90 cm. longi; vaginae papilloso-hispidae vel glabrae, marginibus ciliatis; laminae maximae 3.8 cm. longae, 5 mm. latae, planae, firmae, marginibus cartilaginosis basi papilloso-ciliatis; ligula pilosa 1 mm. longa; racemi maximi 1.8 cm. longi; spiculae 8–11 mm. longae; gluma prima acuminata, 8–11 mm. longa, tuberculata vel tuberculato-hispida, marginibus ciliatis; gluma secunda 6 mm. longa, acuta, supra papilloso-hispida; lemma sterile 5 mm. longum glumae secundae simile; lemma fertile 3.5 mm. longum, pallidum, nitidum.

Culms very slender, wiry, branching, 75–90 cm. long, appressed-pilose; sheaths of the main culm much shorter than the internodes, papillose-hispid, the margins ciliate; blades as much as 3.8 cm. long, 5 mm. wide, some of those on the secondary branches much reduced, flat, firm, pubescent or pilose above, glabrous beneath, the margins white-cartilaginous, more or less papillose-ciliate toward the base; ligule hairy, not more than 1 mm. long, sometimes scarcely evident; racemes somewhat exserted, not more than 1.8 cm. long, subtended by an acute ciliate bract about 3 mm. long, the rachis terminating in a spikelet; spikelets 8–11 mm. long; first glume 8–11 mm. long, that of the terminal spikelet much longer than the others, acuminate, strongly nerved, tuberculate or tuberculate-hispid, the margins ciliate; second glume 6 mm. long, acute, papillose-hispid at the summit; sterile lemma 5 mm. long, similar to the second glume, inclosing a well developed palea; fruit 3.5 mm. long, smooth, shining, narrowly winged below, the base fashioned into a conspicuous circular crown.

Type in the U. S. National Herbarium, no. 1,538,066, collected on open marshy prairie, near Los Amates, Guatemala, March 3, 1932, by Paul Weatherwax (no. 1601).

Echinolaena inflexa (Poir.) Chase,[3] the only other species of this genus in the American tropics, differs from *E. gracile* in having much more robust

[3] Proc. Biol. Soc. Wash. **24**: 117. 1911.

glabrous culms, exserted racemes as much as 4 cm. long, and slightly larger fruits, 3.5–4.5 mm. long.

Axonopus ciliatifolius Swallen, sp. nov.

Culmi dense caespitosi, e rhizomatibus erecti, 50–70 cm. alti; folia basi aggregata; vaginae carinatae, sparse pubescentes; laminae planae, 7–16 cm. longae, 1–2 mm. latae, pilosae, marginibus ciliatis; ligula 0.1 mm. longa; racemi 2–5, subdigitati, adscendentes vel appressi, 3–11.5 cm. longi; spiculae 2–2.3 mm. longae, glabrae vel sparse pubescentes; gluma secunda obtusa lemma sterile aequans; lemma fertile fuscum, nitidum.

Culms densely tufted, erect from short scaly rhizomes, 50–70 cm. tall, with terminal and axillary inflorescences; leaves mostly crowded toward the base, the sheaths keeled, sparsely pubescent, the blades flat, 7–16 cm. long (or those on the innovations sometimes longer), 1–2 mm. wide, pilose on both surfaces, the margins papillose-ciliate, especially toward the base; ligule 0.1 mm. long; racemes 2–5, racemose, ascending or appressed, 3–11.5 cm. long; spikelets 2–2.3 mm. long, glabrous or sparsely pubescent, the second glume and sterile lemma subequal, obtuse, scarcely covering the fruit; fruit dark brown, smooth and shining.

Type in the U. S. National Herbarium, no. 1,503,594, collected at Mountain Pine Ridge, El Cayo District, British Honduras, February 25, 1931, by H. H. Bartlett (no. 11746).

This species is distinguished from *A. purpusii* (Mez) Chase, to which it is closely related, by the presence of the well developed scaly rhizomes.

Axonopus rhizomatosus Swallen, sp. nov.

Culmi caespitosi, e rhizomatibus erecti, 45–85 cm. alti, nodis dense pubescentibus; vaginae carinatae, glabrae vel pilosae; laminae planae, maximae 25 cm. longae, 1–4 mm. latae, scaberulae, basi pilosae, marginibus papilloso-ciliatis, inferiores reductae; ligula 0.1–0.2 mm. longa; racemi 2–4, patentes, subdigitati, 5–13 cm. longi; spiculae 2.5–3 mm. longae pilosae; gluma secunda acuta, quam spicula longior; lemma sterile acutum glumam secundam aequans; lemma fertile pallidum.

Culms, caespitose, erect from short scaly rhizomes, 45–85 cm. tall, the nodes densely pubescent; sheaths keeled, rather densely pilose, especially on the collar, or nearly glabrous; blades flat, as much as 25 cm. long, 1–4 mm. wide, the uppermost reduced, not over 2 cm. long, sometimes nearly wanting, smooth or scaberulous, more or less pilose toward the base, the margins papillose-ciliate for a short distance at the base; ligule 0.1–0.2 mm. long, racemes 2–4, appressed, 5–13 cm. long, subdigitate with one a short distance below the others; spikelets 2.5–3 mm. long; second glume and sterile lemma equal, acute, slightly exceeding the pale or lead-colored fruit, the margins densely pilose, especially toward the summit.

Type in the U. S. National Herbarium, no. 1,013,859, collected on open hillsides wooded with pine, along trail from Los Amates to Izabal, Department of Izabal, Guatemala, May 13, 1919, by S. F. Blake (no. 7766).

Open pine woods, Guatemala, Honduras, and British Honduras.

GUATEMALA: Los Amates to Izabal, *Blake* 7748, 7766, 7767; Secanquim, *Pittier* 214.

BRITISH HONDURAS: Without locality, *Dunlap* in 1920.

HONDURAS: La Florida, *Blake* 7424; Siguatepeque, *Standley* 53611.

Closely allied to the preceding species, but differing in having densely pubescent nodes, larger spikelets with acute rather than obtuse second glume and sterile lemma, and pale instead of brown fruit.

Axonopus multipes Swallen, sp. nov.

Stoloniferus; culmi geniculato-adscendentes, 15–25 cm. alti, glabri, nodiis pubescentibus; vaginae carinatae, compressae, glabrae, superiores elongatae; laminae planae, obtusae, 3–6 cm. longae, 4–8 mm. latae (superiores reductae, 1 cm. longae), glabrae, marginibus basi papilloso-ciliatis; ligula brevis erosa; racemi 2, 3–5 cm. longi, conjugati; spiculae acutae, 3 mm. longae; gluma secunda lemma sterile aequans, quam lemma fertile longior, marginibus pilosis; lemma fertile 2.2–2.3 mm. longum, apice dense pubescens.

Culms geniculate, ascending from stolons, 15–25 cm. tall, glabrous or the nodes pubescent; sheaths compressed, keeled, glabrous, the upper ones elongated, inclosing some of the racemes bearing cleistogamous spikelets; prophyllum 3.5 cm. long; blades flat, obtuse, 3–6 cm. long, 4–8 mm. wide, the uppermost reduced, scarcely more than 1 cm. long, glabrous on both surfaces, the margins papillose-ciliate toward the base; ligule very short, minutely erose; racemes 3–5 cm. long, in pairs, conjugate at the summit of slender peduncles, these 3–10 cm. long, 3–5 of them arising from just above the uppermost node; spikelets acute, 3 mm. long, just reaching the one above in the same row; second glume and sterile lemma equal, exceeding the fruit, the margins and often the internerves silky-pilose; fertile lemma 2.2–2.3 mm. long, minutely cross-wrinkled, densely pubescent at the apex.

Type in the U. S. National Herbarium, no. 928824, collected on sandy prairie, Veracruz, Mexico, Aug. 31, 1910, by A. S. Hitchcock (no. 6578). Also collected at Veracruz by Gouin (no. 25).

Axonopus obtusifolius (Raddi) Chase is allied to this species, but differs in having fewer, racemose racemes and acuminate spikelets 5 mm. long, the second glume and sterile lemma much exceeding the fruit.

Axonopus arsenei Swallen, sp. nov.

Culmi caespitosi, erecti, 40–90 cm. alti, nodis dense hispidis; folia basi aggregata, 1 vel 2 caulinis exceptis; vaginae compressae, carinatae, basi papilloso-hispidae, glandulosae, marginibus ciliatis; laminae planae, 10–18 cm. longae, 5–10 mm. latae (superiores reductae), papilloso-hispidae, marginibus ciliatis; ligula brevis erosa; racemi 2–4, 5–10 cm. longi, racemosi; spiculae acutae, 3.4–3.8 mm. longae; gluma secunda acuta, pilosa, lemma sterile aequans, quam lemma fertile longior; lemma fertile 2.8 mm. longum, apice sparse pubescens.

Culms tufted, erect, 40–90 cm. tall, the nodes densely appressed-hispid with ascending hairs, otherwise glabrous; leaves crowded toward the base, the culms with only one or two above the basal ones; sheaths strongly compressed, keeled, those of the culm leaves shorter than the internodes, papillose-hispid and glandular at the base, the margins more or less ciliate toward the summit, otherwise glabrous or sparsely pilose; blades flat, 10–18 cm. long, 5–10 mm. wide, the uppermost reduced, sometimes only 3 cm. long, more or less papillose-hispid on both surfaces, the margins papillose-ciliate, especially toward the base; ligule very short, erose; peduncles 1–3 from the uppermost sheath (rarely from the lower) the terminal one elongate, the

others mostly inclosed in the sheath; racemes 2–4, 5–10 cm. long, the upper two conjugate, the others 10–20 mm. distant; spikelets acute, 3.4–3.8 mm. long, 5–7 mm. distant in each row of the raceme; second glume and sterile lemma acute, equal, exceeding the fruit, rather densely pilose between the nerves; fruit 2.8 mm. long, minutely roughened, with a few short hairs at the summit.

Type in the U. S. National Herbarium, no. 1,000,427, collected at Loma Santa María, vicinity of Morelia, Michoacán, Mexico, alt. 2,050 meters, Sept. 17, 1910, by Brother G. Arsène (no. 6952). *Arsène* 2919 and 7016, from the same locality, also belong to this species.

Allied to *A. multipes*, but differing in being a much larger plant with long-exserted primary peduncles and only 1 or 2 secondary ones, short-exserted or inclosed in the sheath, and larger spikelets and fruit.

Panicum guatemalense Swallen, sp. nov.

Culmi 75 cm. alti, scaberuli, sparse papilloso-pilosi, ramosi; vaginae glabrae vel sparse papilloso-pilosae, collo dense pubescente; laminae planae, 7–12 cm. longae, 4–10 mm. latae, scaberulae, sparse papilloso-pilosae, marginibus cartilaginosis scabris; ligula membranacea, 0.2 mm. longa; panicula 10 cm. longa, ramis adscendentibus vel appressis e basi floriferis; spiculae 2.2–2.4 mm. longae, appressae, pedicellis quam spiculis brevioribus; gluma prima obtusa, 0.5–1 mm. longa; gluma secunda lemma sterile aequans; lemma fertile 2 mm. longum, nitidum, apice pilosum.

Culms more than 75 cm. tall, scaberulous, sparsely papillose-pilose, much branched above; sheaths glabrous, papillose or papillose-pilose, those of the main culm much shorter than the internodes, those of the branches overlapping, the collar densely pubescent; blades flat, 7–12 cm. long, 4–10 mm. wide, scaberulous, more or less papillose or papillose-pilose, densely pilose on the upper surface at the very base, the white-cartilaginous margins distinctly scabrous; ligule membranaceous, about 0.2 mm. long; panicle 10 cm. long, the branches ascending or appressed, spikelet-bearing from the very base or nearly so; spikelets glabrous, 2.2–2.4 mm. long, appressed, the pedicels shorter than the spikelets; first glume obtuse, 0.5–1 mm. long; second glume and sterile lemma equal, inclosing the fruit; fertile lemma 2 mm. long, shining, sparsely hairy toward the summit.

Type in the U. S. National Herbarium, no. 1,538,064, collected in mountains near Santa María, just south of Quezaltenango, Guatemala, March 25, 1932, by Paul Weatherwax (no. 1689).

This species is related to *Panicum arundinariae* Trin., which differs in the more densely flowered panicle branches, which are usually naked for a short distance at the base, smaller spikelets 1.6 mm. long, and thinner, mostly shorter blades.

Peniculus angustifolius Swallen,[4] was recently described as a new genus and species, based on a collection of H. H. Bartlett (no. 11748) collected on Mountain Pine Ridge, El Cayo District, British Honduras. Mr. C. E. Hubbard of the Herbarium of the Royal Botanic Gardens, Kew, England, has suggested that it belongs in *Mesosetum*. This disposition of the species is correct and it accordingly becomes **Mesosetum angustifolium** Swallen.

[4] Amer. Journ. Bot. 19: 581. *fig. 1.* 1932.

PALEOBOTANY.—*A new* Trichopitys *from the Carboniferous of Colorado.*[1] CHARLES B. READ, U. S. Geological Survey. (Communicated by JOHN B. REESIDE, JR.)

The remains of plants in the Carboniferous strata of western North America are so rare that it seems very desirable to record the occasional well-preserved material which is collected. In this communication an apparently new species of a genus previously unknown in this country is described from the Weber(?) formation of Colorado.

Genus TRICHOPITYS Saporta, 1875[2]

Trichopitys whitei, n. sp.

Leaves 80 millimeters or more in length and of approximately the same breadth, obtriangular in outline, dissected into narrow, linear lobes; base narrowly cuneate, lamina expanded rapidly into several times dichotomous lobes. Primary lobes 2 millimeters in breadth, soon bifurcating into slightly narrower, subequal laminae which fork at least once and probably twice to acutely pointed terminations. Nervation of two basal veins dichotomizing to supply the distal lobes with one to three heavy, deeply imbedded, evenly spaced veins. Texture coriaceous; lobes thick and rounded in cross-section.

Collected by J. H. Johnson, C. D. Hier, and the writer from the Weber (?) formation about 100 feet above the base, about 3 miles east of Leadville, Colo., on the west face of Evans Peak.

This species is named in honor of the American paleobotanist, Mr. David White.

Figure 1 is a photograph of a well-preserved specimen of *Trichopitys whitei* as it occurs on a thin slab of shale. The most striking features are the nearly regular dichotomies, the short base, and the modified obtriangular outline. The apices of the ultimate lobes have been restored from another specimen. It will be noticed that they are very acute. In comparison with European species of the genus, *Trichopitys whitei* is small and also shows a marked departure in having a short base.

In the enlargment of the specimen described above one may discern the details of venation. The vascular system dichotomizes with the leaf so that the ultimate lobes carry one to three veins. An important feature which the figures fail to bring out clearly is the biconvex or rounded cross-sectional shape of the segments. This is similar to the shape of recent coniferous leaves and may be a xerophytic adaptation.

Concerning the generic identification there can be little question. The only other well-founded Paleozoic genus which allows close comparison is *Dicrano-*

[1] Published by permission of the Director of the U. S. Geological Survey. Received June 17, 1933.

[2] SAPORTA, G. de. *Sur la découverte de deux types nouveaux des conifères dans les schistes permiens de Lodève (Hérault).* Comptes Rendus, 80: 1020. 1875.

Figure 1.—*Trichopitys whitei* n. sp. showing the general appearance and details of venation, ×1 and ×3.

phyllum Grand'Eury.[3] As contrasted with *Trichopitys* this genus is characterized by smaller, more rigid, and more equally dichotomous leaves, so that a nearly perfect bilateral symmetry is produced. In addition there are features of the fructifications and of the arrangement of sterile leaves on the stem which distinguish the two. Unfortunately, such materials have not been available in the present case.

No described species of the genus are very close to *Trichopitys whitei*. *Trichopitys millerensis* Renault,[4] from the Autun-Epinac Basin shows some resemblance but is larger and more rigid. In addition, the details of venation differ.

A very interesting similarity exists between *Trichopitys* and the Mesozoic genus *Czekanowskia*. This suggests the possibility of extreme antiquity for the Ginkgoales, and this theory receives support from several other Paleozoic genera. It is beyond the scope of this paper to discuss the problem, but it may be pointed out that the criterion of external leaf form is not sufficient basis for a definite statement concerning the stratigraphic range of the Ginkgoales. The fructifications of *Trichopitys hetermorpha* Saporta[5] do not indicate any close affinity with the ginkgophytes as the writer understands them. *Trichopitys* is more likely a pteridosperm, it would seem, although the evidence is very meager. For the present it is best to follow Arber and assign the genus to the Palaeophyllales.[6]

Concerning the age of the beds from which *Trichopitys whitei* was collected, there is a strong suggestion that it is Pottsville. A small flora was found associated and contains several species which are very characteristic of lower Pennsylvanian strata. Since this flora is discussed in full in a paper soon to be published, it is not necessary to go into the details of the correlation here. *Trichopitys whitei* affords little evidence for or against this conclusion, since the genus has a sporadic and incompletely known distribution. It ranges from the "Upper Carboniferous" through the Permian in Europe and has been reported from the Triassic.

[3] GRAND'EURY, F. C. *Flore carbonifère du département de la Loire*, p. 272. 1777.
[4] RENAULT, B. *Bassin houiller et permien d'Autun et Épinac: Atlas*, pl. 82, fig. 2. 1893; text, p. 378. 1886.
[5] SAPORTA, G. DE. *Sur la découverte de deux types nouveaux des conifères dans les schistes permiens de Lodève (Hérault)*. Comptes Rendus, 80: 1020. 1875.
[6] ARBER, E. A. N. O. *On* Psygmophyllum majus *sp. nov. from the Lower Carboniferous rocks of Newfoundland, together with a revision of the genus and remarks on its affinities*. Linnean Soc. London Trans. 7(pt. 18): 405. 1912.

ZOOLOGY.—*New mammals from Arizona, New Mexico, and Colorado.*[1] E. A. GOLDMAN, Biological Survey.

More critical regional studies of the rodent genera *Thomomys*, *Perognathus*, *Dipodomys*, and *Neotoma* have resulted in the segrega-

[1] Received August 24, 1933.

tion of several new geographic races. Some of these are based in part upon material collected many years ago, but it was not until additional specimens were obtained that the distinctive characters became apparent.

Thomomys alexandrae, sp. nov.

Navajo Pocket Gopher

Type.—From plain 5 miles southeast of Rainbow Lodge, near Navajo Mountain, Coconino County, Arizona (altitude 6,200 feet). No. 250969, ♂ adult, skin and skull, U. S. National Museum (Biological Survey collection), collected by E. A. Goldman, June 16, 1933. Original number 23613.

Distribution.—Vicinity of the type locality on the arid, brush-covered plains in the triangular area lying between the Colorado and San Juan rivers and Navajo and Piute creeks, in northern Arizona and extreme southern Utah.

General characters.—A small, cinnamon buffy species; skull slender in proportions; mammae in 4 pairs, pectoral 2–2, inguinal 2–2. Allied to *Thomomys fulvus aureus* of the adjoining desert region of Arizona, but decidedly smaller; color much duller, near cinnamon buff, instead of rich ochraceous tawny; cranial characters distinctive.

Color.—*Type* (summer pelage): Upper parts light cinnamon buff, purest along sides, the top of head and back somewhat darkened by black-tipped hairs; middle of face and muzzle blackish; black auricular spots conspicuous, encircling entire ears; under parts, forearms, and thighs pale ochraceous buff; feet white; tail brownish above on basal half, becoming white toward tip, and whitish below. Some of the topotypes are distinctly blackish on head. *Young* (in first pelage): Upper parts lighter, more pinkish buffy, except on face which is dusky, much as in adults.

Skull.—Similar in general to that of *T. f. aureus,* but smaller, flatter, more slender in structure; temporal ridges more widely separated; zygomata more slender, the external angle near point of union of maxilla and jugal less prominent; rostrum relatively shallower; audital bullae relatively smaller, less fully inflated; dentition relatively lighter.

Measurements.—*Type:* Total length, 210 mm.; tail vertebrae, 60; hind foot, 28. An adult male topotype: 214; 61; 28. Two adult female topotypes, respectively: 215, 205; 70, 62; 27, 28. *Skull* (type): Condylobasal length, 38.3; zygomatic breadth, 23.5; greatest breadth across squamosals (over mastoids), 18.8; interorbital constriction, 6.8; length of nasals, 13.5; maxillary toothrow (alveoli), 8.2.

Remarks.—*Thomomys alexandrae* is evidently allied to *T. f. aureus* which has an extensive range in neighboring territory, but there is no evidence of intergradation. The new species has been isolated perhaps for thousands of years by effective barriers formed by Navajo and Piute creek canyons. Bare rock walls, or cliffs, hundreds of feet in height, extend from the canyon mouths to a very narrow, rocky and sterile backbone forming a dividing line where conditions appear to be unsuitable for pocket gophers. The species is named for Miss Annie M. Alexander whose own faunal investigations and generous support of the studies by others have contributed greatly to knowledge of the mammals of western states.

Specimens examined.—Total number, 11 (2 in collection University of Arizona), all from the type locality.

Perognathus amplus jacksoni, subsp. nov.

Yavapai Pocket Mouse

Type.—From Congress Junction, Yavapai County, Arizona (altitude 3,000 feet). No. 212780, ♂ adult, skin and skull, U. S. National Museum (Biological Survey collection), collected by H. H. T. Jackson, June 21, 1916. Original number 381.

Distribution.—Desert regions of central-western and south-central Arizona, south of the range of the typical subspecies, *Perognathus amplus amplus.*

General characters.—A large, richly colored subspecies, with a broad, heavy skull. Similar in size to *Perognathus amplus amplus* of the Verde River Valley, but paler buff, upper parts less obscured by dusky hairs and cranial characters distinctive; tail slightly crested near end and tufted as in *amplus.* Larger and richer colored, the back less blackish than *P. a. pergracilis* of northwestern Arizona, and skull differing in detail. Decidedly larger than *P. a. taylori* of southeastern Arizona; color slightly paler buff, less mixed with dusky. Similar in size to *P. a. rotundus* of southwestern Arizona, but darker pinkish buff, and skull different. Distinguishable from both *P. a. cineris* and *P. a. ammodytes* of the valley of the Little Colorado River, by larger size and less dusky upper parts (contrasting strongly in color with *cineris*).

Color.—*Type* (fresh pelage): Ground color of upper parts nearly uniform pinkish buff, purest on the lateral line from cheeks across shoulders and along lower part of flanks to thighs, the top of head and back finely and rather inconspicuously lined with black; under parts, fore limbs and hind feet white; ears buffy externally, except anterior fold which is dusky, sparsely clothed internally with blackish hairs, and edged with white near posterior base; a tiny but distinct tuft of white hairs on margin of ear at anterior base; tail thinly haired, light brownish above, dull whitish below, becoming dusky on the small terminal tuft.

Skull.—Similar in size to that of *P. a. amplus,* but less flattened; mastoids narrower, less inflated posteriorly, and less bulging along line of contact with parietals; rostrum and nasals broader, less depressed anteriorly; interparietal less depressed between mastoids; audital bullae and dentition similar. Size about as in *rotundus,* but frontal region less flattened; mastoids less bulging along parietal margins; rostrum broader. Larger than *taylori, cineris,* or *ammodytes.* Compared with that of *pergracilis* the skull is considerably larger, with a relatively narrower frontal region.

Measurements.—*Type:* Total length, 168 mm.; tail vertebrae, 85; hind foot, 21. Average of four adult topotypes: 160 (152–165); 85 (81–87); 21.5 (21–22). *Skull* (type): Length (median line), 25.5; greatest breadth (across audital bullae at meatus), 15; zygomatic breadth (posteriorly), 13.3; interorbital breadth, 5.5; length of nasals, 10; width of nasals (in front of incisors), 2.5; interparietal, 2.8×2.8; maxillary toothrow (alveoli), 3.5.

Remarks.—The material upon which *Perognathus amplus jacksoni* is based has hitherto been regarded by me provisionally as referable to the typical form, *P. a. amplus.* Further study has, however, led me to believe that typical *amplus* may be restricted to the upper part of the Verde River Valley. The

recent discovery of two new subspecies, *P. a. cineris* and *P. a. ammodytes*, described by Benson (Proc. Biol. Soc. Washington, vol. 46, pp. 109–110, Apr. 27, 1933), extended the known range of the species into the Upper Sonoran Zone in the Little Colorado River Valley. Fairly well marked geographic races of *P. amplus* are more limited in distribution than is usual in most species of the genus.

Specimens examined.—Total number, 37, all from Arizona, as follows: Congress Junction (type locality), 17; Kirkland, 17; Phoenix, 1; Rice, 1; Wickenburg, 1.

Dipodomys spectabilis perblandus, subsp. nov.

Western Banner-tailed Kangaroo Rat

Type.—From Calabasas, Santa Cruz County, Arizona (altitude about 3,500 feet). No. 17748/24689, ♀ adult, skin and skull, U. S. National Museum (Biological Survey collection), collected by Vernon Bailey, October 27, 1889. Original number 611.

Distribution.—Western desert region of central-southern Arizona, from the vicinity of Tucson west at least to Gunsight, and south into adjoining parts of Sonora.

General characters.—Closely allied to *Dipodomys spectabilis spectabilis* of southeastern Arizona, but smaller and paler, the upper parts more thinly mixed with black; black facial mask less distinct; tail less extensively tipped with white. Cranial characters also distinctive.

Color.—*Type* (fresh pelage): Upper parts in general light ochraceous buff, purest on cheeks, shoulders, sides, and outer surfaces of thighs, the top of head and back thinly mixed with black; under parts, postauricular and supraorbital spots, fore limbs, hind feet above, hip stripes, and tail at extreme base all around pure white; tail beyond base black mixed with gray above and below, becoming nearly black in a subterminal zone all around, abruptly interrupted by the pure white tip 40 millimeters in length, the sides white along lines narrowing gradually and disappearing in the subterminal area mentioned; soles of hind feet brownish; ears whitish externally, except anterior fold which is dusky, thinly clothed internally with minute black hairs.

Skull.—Similar to that of *D. s. spectabilis*, but decidedly smaller; mastoids relatively smaller; interparietal and supraoccipital usually actually as well as relatively broader at constriction between mastoids; dentition lighter, the incisors and molariform teeth distinctly narrower.

Measurements.—*Type:* Total length, 315 mm.; tail vertebrae, 184; hind foot, 48. Average of 10 adult topotypes: 327 (313–340); 194 (179–204); 48 (44–52). *Skull* (type): Occipitonasal length, 41; greatest breadth (between outer sides of audital bullae), 27.8; breadth across maxillary arches, 26; length of nasals, 14.9; width of nasals (in front of incisors), 4.2; least width of supraoccipital (near interparietal), 2.3; maxillary toothrow (alveoli), 5.2.

Remarks.—*Dipodomys spectabilis perblandus* is a well-marked subspecies, although not far removed geographically from *D. s. spectabilis*. It occupies the desert area west of the range of *spectabilis* which is typical in the higher plateau region of southeastern Arizona.

Specimens examined.—Total number, 44, as follows:

ARIZONA: Baboquivari Mountains (Peters Ranch), 1; Calabasas (type locality), 10; Gunsight, 2; Indian Oasis, 4; La Osa, Pima County, 7; Oracle, 6; Santa Rita Mountains (north base), 2; Tucson, 5; Tucson (30–35 miles south), 3; Tucson (75 miles southwest), 2.

SONORA: Magdalena, 2.

Dipodomys spectabilis clarencei, subsp. nov.

Northern Banner-tailed Kangaroo Rat

Type.—From Blanco, San Juan County, New Mexico. No. 158824, ♂ adult, skin and skull, U. S. National Museum (Biological Survey collection), collected by Clarence Birdseye, November 19, 1908. Original number 443.

Distribution.—San Juan River Valley in northwestern New Mexico, northeastern Arizona and probably southeastern Utah and southwestern Colorado.

General characters.—Similar to *Dipodomys spectabilis spectabilis* of southeastern Arizona but larger; color usually paler and grayer, the upper parts suffused with pinkish instead of ochraceous buff; cranial characters distinctive; tail crested with black and broadly tipped with white as in *spectabilis*. Resembling *D. s. baileyi* of southeastern New Mexico in color, but black mask less distinct across middle of face, the upper surface of muzzle behind nasal pad more extensively white; skull smaller and differing in detail.

Color.—Type (fresh pelage): Upper parts in general near pinkish buff, purest on cheeks, shoulders, sides, and outer surfaces of thighs, the top of head and back more profusely but moderately mixed with black; under parts, postauricular and supraorbital spots, fore limbs, hind feet above, hip stripes, and tail at extreme base all around pure white; tail beyond base black mixed with gray above and below, becoming nearly pure black in a subterminal zone all around, abruptly interrupted by the pure white tip 50 millimeters in length, the sides white along lines narrowing to the subterminal area mentioned; hind legs above ankles blackish all around; soles of hind feet blackish; ears whitish externally, except anterior fold which is black, thinly clothed internally with minute black hairs.

Skull.—Similar to that of *D. s. spectabilis*, but larger; mastoids larger; maxillary arches broader and extending farther forward beyond frontals along outer side of premaxillae (as viewed from above). Compared with that of *baileyi* the skull is smaller, with a relatively broader frontal region; maxillary arches with more strongly developed external angles (tending to form more strongly projecting hooks); incisors narrower.

Measurements.—Type: Total length, 375 mm.; tail vertebrae, 213; hind foot, 54. Two adult topotypes, respectively: 365, 365; 204, 195; 54, 54. *Skull* (type): Occipitonasal length, 44.8; greatest breadth (between outer sides of audital bullae), 29.5; breadth across maxillary arches, 27; length of nasals, 17.2; width of nasals (in front of incisors), 5; least width of supraoccipital (near interparietal), 2.3; maxillary toothrow (alveoli), 6.1.

Remarks.—Typical *Dipodomys spectabilis clarencei* is probably restricted to the San Juan River Valley. Specimens from Gallup, New Mexico, grade toward *baileyi*. No specimens are available from Arizona but E. W. Nelson writing in August, 1909, says: "Much to our surprise we found the sandy mesa on the west side of Chin Lee Valley, from 10 to 25 miles southwest of

Chin Lee, thickly dotted with the unmistakable mounds and burrows of this species" [*Dipodomys spectabilis*]. The new form is named for the collector, Clarence Birdseye, in recognition of his notable contributions to knowledge of wild animal life.

Specimens examined.—Total number, 9, all from New Mexico, as follows: Blanco (type locality), 3; Fruitland, 4; Gallup (15 miles northwest), 2.

Dipodomys ordii evexus, subsp. nov.

Upper Arkansas Valley Kangaroo Rat

Type.—From Salida, Chaffee County, Colorado (altitude 7,000 feet). No. 150990, ♂ adult, skin and skull, U. S. National Museum (Biological Survey collection), collected by Merritt Cary, November 10, 1907. Original number 1245.

Distribution.—Upper part of the Arkansas River Valley, above the Royal Gorge, south-central Colorado.

General characters.—An ochraceous buff subspecies closely allied to *Dipodomys ordii richardsoni* of the prairie region to the eastward, but tail longer, the dusky stripe on under side extending nearer to tip (usually limited to basal half in *richardsoni*), and cranial proportions, especially the smaller mastoids, distinctive. Smaller and darker than *D. o. luteolus* of the plains of Wyoming and Montana. Distinguished from *D. o. montanus* of the upper Rio Grande Valley, southern Colorado, by larger size and rich ochraceous buff coloration, the upper parts much less heavily mixed with black.

Color.—*Type* (fresh pelage): Upper parts near rich ochraceous buff, thinly mixed with black, the buffy element purest and brightest on cheeks, shoulders, flanks and outer surfaces of thighs; underparts, supraorbital and postauricular spots, fore limbs, hind feet above, and hip stripes pure white; facial mask and soles of hind feet black; ears whitish externally, except anterior fold which is dusky, thinly clothed internally with minute hairs; tail above blackish, becoming brownish at tip, below brownish along basal two-thirds beyond which the white side stripes become confluent.

Skull.—Similar to that of *richardsoni*, but basicranial region more evenly rounded above, owing to slight depression and greater breadth of interparietal and supraoccipital, and to lesser inflation of mastoids; mastoid and audital bullae smaller; maxillary arches less strongly developed; nasals shorter; incisors narrower. Distinguished from that of *luteolus* mainly by smaller size. Compared with that of *montanus* the skull is larger, more robust; mastoids less rounded and inflated; interparietal and supraoccipital relatively broader, less depressed between mastoids.

Measurements.—*Type:* Total length, 266 mm.; tail vertebrae, 149; hind foot, 42. Average of four adults from type locality: 258 (233–273); 151 (146–159); 42 (41–42). *Skull* (type): Occipitonasal length, 37.3; greatest breadth (between outer sides of audital bullae), 24; breadth across maxillary arches, 21.3; length of nasals, 13.9; width of nasals (in front of incisors), 3.8; least width of supraoccipital (near interparietal), 3; maxillary toothrow (alveoli), 4.8.

Remarks.—The differential characters of the kangaroo rats inhabiting the high valley near the headwaters of the Arkansas River were noted by me in identifying material obtained by Merritt Cary in connection with the biolog-

ical survey of Colorado many years ago. At that time, however, it seemed best to refer them to *richardsoni* and this course was followed by Cary (North Amer. Fauna No. 33, pp. 140–142, Aug. 17, 1911) who says of them: "The Salida series is not typical *P[erodipus] richardsoni*," and he further remarks in regard to the animals of the area: "The Royal Gorge, and in fact much of the Canyon of the Arkansas, would seem to prevent continuity of range from the plains." *D. o. evexus* is not very unlike typical *D. o. ordii* of western Texas in color, but is a larger, more robust animal, differing also in cranial details, and requiring no close comparison.

Specimens examined.—Seven, all from the type locality.

Dipodomys ordii cleomophila, subsp. nov.

Cinder Bed Kangaroo Rat

Type.—From 5 miles northeast of Winona, Coconino County, Arizona (altitude 6,200 feet). No. 226348, ♀ adult, skin and skull, U. S. National Museum (Biological Survey collection), collected by E. A. Goldman, July 16, 1917. Original number 23101.

Distribution.—Little Colorado Valley slopes of the Coconino and Mogollon plateaus from Flagstaff and vicinity to Springerville, eastern Arizona.

General characters.—Closely allied to and intergrading with *Dipodomys ordii longipes* of the Painted Desert region, northeastern Arizona, but upper parts distinctly darker, near cinnamon buff instead of light ochraceous buff; black facial markings more distinct; skull slightly different. Distinguished from *D. ordii chapmani* of the Verde River Valley by more robust proportions, and much richer, more rufescent coloration.

Color.—Type: Upper parts in general near cinnamon buff (Ridgway, 1912), moderately mixed with black, the buffy element purest and most intense on middle of face, shoulders and flanks; under parts, postauricular spots, fore limbs, hind feet above, usual hip stripes, and tail at extreme base all around pure white; tail beyond extreme base blackish along upper and lower median stripes to near tip where the lengthening hairs become dusky all around, the sides white to subterminal area mentioned; pencilled tip of tail inconspicuously dusky, the dark points of hairs only partially concealing the white under color; soles of hind feet blackish to toes, which are white; ears thinly clothed with short hairs, blackish internally and whitish externally, except anterior fold which is dusky; blackish facial markings broad and distinct. *Young* (in first pelage): Decidedly darker, more cinnamon buffy than in *longipes* of corresponding age.

Skull.—Essentially as in *D. o. longipes* but usually slightly smaller, with smaller mastoids, and relatively narrower maxillary arches. Much larger than that of *D. o. chapmani*, with relatively larger mastoids.

Measurements.—Type: Total length, 250 mm.; tail vertebrae, 149; hind foot, 41.5. Five adult topotypes: 253 (245–260); 143 (135–149); 42 (40–43.5). *Skull* (type): Greatest length (on median line), 37.5; greatest breadth (between outer sides of audital bullae), 25.2; breadth across maxillary arches, 20.5; least width of supraoccipital (near interparietal), 2.2; maxillary toothrow (alveoli), 5.

Remarks.—Like several other geographic races of small rodents inhabiting the volcanic region east of San Francisco Mountain, *D. o. cleomophila* is

characterized by relatively darker coloration. It differs from *D. o. longipes* of the adjoining Painted Desert much as *Perognathus flavus fuliginosus* and *Perognathus apache cleomophila* differ from *P. f. hopiensis* and *P. a. apache*, respectively. Specimens from Walnut Tank, 10 miles north of Angell and from Cedar Ranch Wash, a short distance west of the Little Colorado River grade toward *longipes*, but especially in the more distinct blackish markings are nearer to the new form. No intergradation is apparent with *D. o. chapmani*, which is isolated by the higher parts of the Coconino-Mogollon Plateau. The name of this subspecies is derived from that of the plant, *Cleome serrulata*, many seeds of which were found in the cheek pouches of the kangaroo rats at the type locality.

Specimens examined.—Total number, 39, from Arizona, as follows: Cedar Ranch Wash (3 miles above confluence with Little Colorado River, near Cameron), 10; Flagstaff, 1 (skull only); Tanner Tank, 2; Springerville, 7; Walnut Tank (10 miles north of Angell), 10; Winona (5 miles northeast—type locality), 9.

Dipodomys ordii nexilis, subsp. nov.

Upper Colorado Valley Kangaroo Rat

Type.—From 5 miles west of Naturita, Montrose County, Colorado. No. 149938, ♂ adult, skin and skull, U. S. National Museum (Biological Survey collection), collected by Merritt Cary, July 20, 1907. Original number 1068.

Distribution.—Narrow valleys along the upper affluents of the Colorado River, the Grand, Gunnison, and Dolores rivers, in southwestern Colorado. Probably occurs also in the Colorado River Valley, southeastern Utah.

General characters.—A large, comparatively dark subspecies, with black markings well developed. Closely allied to *D. o. longipes*, but decidedly darker; black facial mask much more prominent; ears, soles of hind feet, and tail above and below more extensively black; tail with lateral white lines narrower, and dark lines correspondingly broader; cranial details slightly different. Similar in color to *D. o. cleomophila*, but larger, and still darker in tone; skull more massive.

Color.—Type (acquiring fresh pelage): Upper parts near cinnamon buff, purest on cheeks, shoulders, flanks and thighs, the top of head and back moderately mixed with black; under parts, supraorbital and postauricular spots, forelimbs, upper surface of hind feet, and hip stripes pure white; facial mask deep black, broad and distinct across muzzle; inner sides and anterior folds of ears blackish; soles of hind feet deep black from base of toes to heels; tail with broad blackish stripes above and below, becoming brownish all around at tip, the white lateral lines narrow—only about half the width of the dark lines.

Skull.—Very similar to those of *longipes* and *cleomophila*, but mastoid and audital bullae usually still more distended; rostrum and nasals usually slightly broader.

Measurements.—Type: Total length, 268 mm.; tail vertebrae, 147; hind foot, 45. Average of three adults from type locality: 271 (265–280); 148 (142–154); 45 (45–45). *Skull* (type): Occipitonasal length, 39; greatest breadth (between outer sides of audital bullae), 26; breadth across maxillary

arches, 21.3; length of nasals, 14.6; width of nasals (in front of incisors), 4.3; least width of supraoccipital (near interparietal), 2.3; maxillary toothrow, 5.2.

Remarks.—*Dipodomys ordii nexilis* probably intergrades with *longipes*, along the narrow valley of the Colorado River in southeastern Utah. Specimens from Fruita and Grand Junction are lighter buff than those from the type locality, and more closely approach *longipes* in color. In the distension of the mastoid and audital bullae, however, they are very similar to topotypes of the new form. The range of *nexilis* is separated from that of *D. o. evexus* by the high, narrow continental backbone formed by the Rocky Mountains. These subspecies of *D. ordii* contrast strongly in cranial features, especially the disparity in the size of the mastoid bullae.

Specimens examined.—Twelve, all from Colorado, as follows: Coventry, 2; Fruita, 1; Grand Junction, 4; Hotchkiss, 1; Naturita (type locality), 4.

Neotoma mexicana inopinata, subsp. nov.

Chuska Mountains Wood Rat

Type.—From Chuska Mountains, northwestern New Mexico (altitude 8,800 feet). No. 158395, ♂ adult, skin and skull, U. S. National Museum (Biological Survey collection), collected by Clarence Birdseye, October 3, 1908. Original number 246.

Distribution.—Broken or mountainous areas in northwestern New Mexico, northeastern Arizona, southwestern Colorado and probably southeastern Utah.

General characters.—Similar in size to *Neotoma mexicana fallax* of the Rocky Mountains of Colorado, but color paler, and cranial characters distinctive. Distinguished from *N. m. pinetorum* of the San Francisco Mountain region, by smaller size and decidedly paler color.

Color.—*Type* (fresh autumn pelage): Upper parts light ochraceous buff, purest on cheeks, shoulders, and sides, rather thinly overlaid on top of head and over back by black-tipped hairs; under parts white, the fur basally plumbeous, except axillae and small areas on inner sides of thighs where the hairs are pure white to roots; ears dusky, narrowly edged with gray; feet white; tail sharply bicolor, brownish with a slight grayish admixture above, white below. Young individuals are paler and grayer than adults in general tone.

Skull.—Similar in size to that of *fallax*, but more angular, the basicranial ridges more prominent, and braincase less evenly rounded; frontal region narrower posteriorly, the supraorbital ridges more nearly parallel (supraorbital ridges more divergent posteriorly in *fallax*); premaxillae usually less extended posteriorly, only slightly exceeding nasals (usually reaching well beyond nasals in *fallax*); outer wall of antorbital foramen broader, reaching farther anteriorly, the antorbital notch slightly deeper as viewed from above; dentition about the same. Closely resembling that of *pinetorum*, but smaller; zygomata relatively less widely spreading.

Measurements.—*Type:* Total length, 364 mm.; tail vertebrae, 160; hind foot, 36. An adult male topotype: 360; 161; 36. *Skull* (type): Greatest length, 46.2; condylobasal length, 43.9; zygomatic breadth, 24; interorbital

constriction, 5.3; length of nasals, 19.2; length of incisive foramina, 10; length of palatal bridge, 8.5; maxillary toothrow (alveoli), 9.

Remarks.—The collection of additional specimens from Arizona in recent years has indicated the desirability of recognizing a new geographic race of *Neotoma mexicana*, with a general range as here outlined. Specimens from several localities in northwestern New Mexico and southwestern Colorado, formerly referred by me (North Amer. Fauna, No. 31, pp. 57–58, Oct. 19, 1910) to *fallax* are transferred to the new form. In color *N. m. inopinata* resembles typical *mexicana*, but is much larger and evidently more nearly related to *fallax* and *pinetorum*. It apparently intergrades with both.

Specimens examined.—Total number, 20, as follows:

ARIZONA: Tunitcha Mountains, 4 (Canyon del Muerto, 6,800, feet, 1; head of Spruce Creek, 9,000 feet, 2; Wheatfield Creek, 7,000 feet, 1); Lukachukai Mountains (8,000 feet), 1.

COLORADO: Ashbaugh Ranch, Montezuma County, 1.

NEW MEXICO: Chuska Mountains (type locality), 7; Fruitland, 2; Gallup, 2; Zuni Mountains, 3.

Neotoma micropus leucophaea, subsp. nov.

White Sands Wood Rat

Type.—From White Sands, 10 miles west of Point of Sands, White Sands National Monument, Otero County, New Mexico (altitude 4,100 feet). No. 251057, ♂ adult, skin and skull, U. S. National Museum (Biological Survey collection), collected by W. P. Taylor, May 6, 1933.

Distribution.—Known only from the dunes of whitish drifted sand in the vicinity of the type locality.

General characters.—An ashy gray subspecies, closely allied to *Neotoma micropus canescens* of the surrounding territory, but still paler; fur of under parts more extensively white to roots; ears grayer; tail brownish black, mixed with gray above (more nearly pure black in *canescens*).

Color.—*Type* (fresh summer pelage): Upper parts pale ashy gray or near pale smoke gray (Ridgway, 1912), purest on cheeks, shoulders, and sides, the top of head and back thinly mixed with black producing a finely lined effect; under parts white, the fur pure white to roots nearly everywhere except on sides of abdomen where the basal color is pale plumbeous; ears scantily haired, brownish gray externally, grayish internally; feet white; tail brownish black mixed with gray above, white below.

Skull.—As in *canescens*.

Measurements.—*Type:* Head and body (tail defective), 198 mm.; hind foot, 36. An adult male topotype: 348; 139; 34. *Skull* (type): Greatest length, 45; condylobasal length, 43.9; zygomatic breadth, 25.3; interorbital constriction, 5.9; length of nasals, 17.5; length of incisive foramina, 9; length of palatal bridge, 8.7; maxillary toothrow (alveoli), 8.9.

Remarks.—*Neotoma micropus leucophaea* is a slightly differentiated, local race probably restricted to the dunes of whitish drifted sand which, in contrast with the darker and harder soils of the surrounding country, are so

conspicuous a feature of the land surface miles in extent in Otero County, New Mexico. It is another example of the evident relation of color to environment in many mammals. Pallid coloration in this case is associated with whitish sand. The new form requires close comparison only with *canescens*.

Specimens examined.—Four, all from the type locality.[2]

[2] One in Mus. Univ. of Arizona.

ENTOMOLOGY.—*New Rutelinae (Col. lamell.) in the United States National Museum.*[1] FRIEDRICH OHAUS, Mainz, Germany. (Communicated by HAROLD MORRISON.)

In a collection of Rutelinae sent to me for naming there were the following new species, the descriptions of which I publish herewith.

Hypaspidius morio, n. sp.

Oblongo-ovatus, postice leviter ampliatus, supra et subtus unicolor niger nitidus; supra glaber, pygidio, pectore pedibusque sparsim fuscohirsutus. Clipeus oblongo-parabolicus, dense aciculatus, margine leviter elevatus. Caput, thorax et scutellum polita vix perspicue disperse punctulata. Scutellum longitudine vix latius. Elytrorum striae in disco regulares at non profundae, basin et apicem versus evanescentes, in lateribus irregulares plerumque evanescentes, interstitio subsuturali punctis nonnullis parvis. Pygidium dense aciculatum sericeum, apice et lateribus fusco-pilosum. Abdominis segmenta linea transversa punctorum piligerorum instructa, membrana inter sternitum ultimum et penultimum lata flavorufa. Sterna et coxae dense aciculata et fusco-pilosa; processus sternalis latus brevis apice rotundatus paulo declivis. Antennae fuscae. Aedeagus, Fig. 1.

Length, 25–26, breadth, 15.5–16, mm. ♂ ♀.

Locality, Venezuela: Merida.

Type and paratype, U.S.N.M. Cat. No. 43318.

Anomala (Aprosterna) quirina, n. sp.

A. cincta Say et *testaceipennis* Bl. affines. Oblongo-ovata, postice leviter ampliata, parum convexa, flavotestacea nitida, supra capita, thorace (lateribus exceptis), scutello et elytrorum margine angusto, subtus tibiis tarsisque laete viridi-aeneis; supra glabra, subtus cum pygidio sparsim flavopilosa. Clipeus cum fronte subtiliter dense rugulosa, vertex, thorax et scutellum fortius singulatim punctata; elytra regulariter seriato-punctata, punctis fortibus, seriebus vix vel non sulcatis. Pygidium punctis annularibus transversim confluentibus dense obtectum, parum nitidum, apice et lateribus solum sparsim pilosum. Abdominis sternita medio sparsim, lateribus densius confluenter punctata; metasterni latera dense confluenter punctata ac pilosa; mesosternum inter coxas intermedias latum tumidulum, at coxas non superans. Tibiae anticae tridentatae, intermediae et posticae suratae, bicarinatae. Antennae fulvotestaceae, clava concolore.

Length, 13–14, breadth, 7–7.5 mm. ♂ ♀.

[1] Received July 14, 1933.

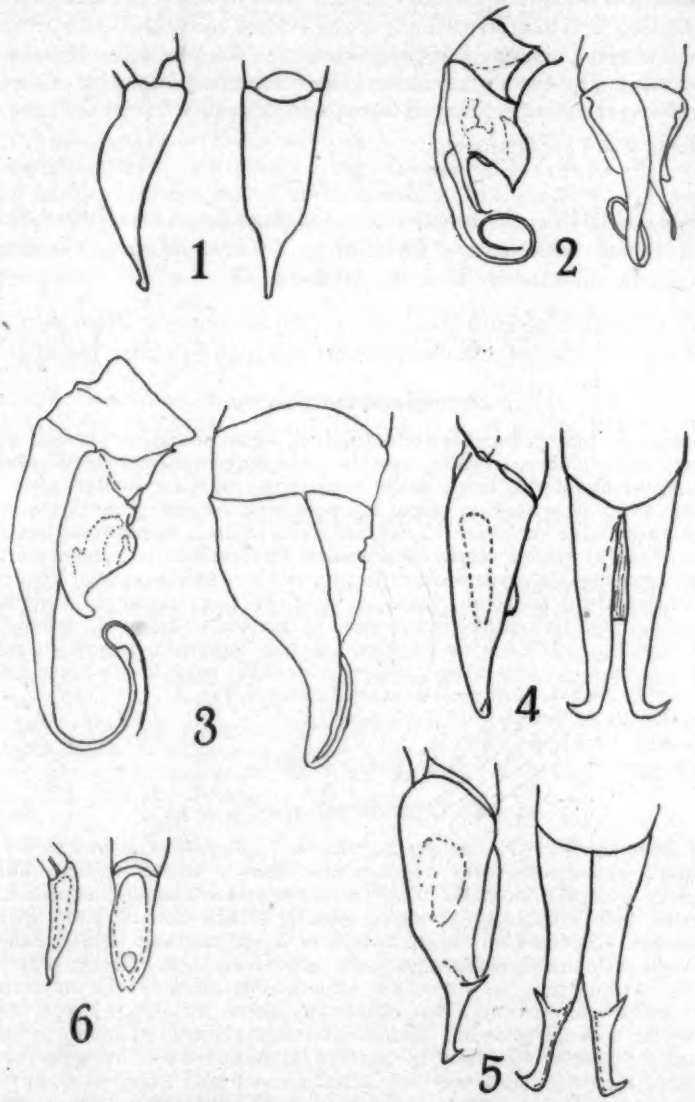

Fig. 1.—Aedeagus of *Hypaspidius morio*, n. sp. Fig. 2.—Aedeagus of *Anomala ebenina* Fairmaire. Fig. 3.—Aedeagus of *Anomala filigera*, n. sp. Fig. 4.—Aedeagus of *Anomala semicastanea* Fairmaire. Fig. 5.—Aedeagus of *Anomala rufithoraz*, n. sp. Fig. 6.—Aedeagus of *Lepadoretus subcostatus*, n. sp.

Locality, Venezuela: Cumaragua, B. J. Blanco, collector.
Type and paratype, U.S.N.M. Cat. No. 43319.

Anomala flamina, n. sp.

A. championi H. Bates proxime affinis. Ovalis sat convexa, rufotestacea leviter viridiaenescens, vertice fuscoaeneo; thoracis maculis duabus discalibus, elytrorum maculis duabus pone scutellum et vittis duabus transversis, una mediana, altera praeapicali indistincta fuscis, tibiis posticis rufocupreis, tarsis omnibus fuscoviridi-aeneis. Supra cum pygidio glabra nitida, subtus cum pedibus sparsim ac breviter flavopilosa.

Length, 12–13, breadth, 6.5–7, mm. ♀.

Locality, Guatemala: Alta Vera Paz, Cacao, Trece Aguas, April 21–25, Schwarz and Barber, collectors.

Type and paratype, U.S.N.M. Cat. No. 43320.

Anomala obovata, n. sp.

A. foraminosa et *millepora* H. Bates proxime affines. Obovata, postice valde ampliata, sat convexa; supra et subtus fuscoviridi-aenea, nitida; supra glabra, pygidio sparsim, pectore densius ac longius vulpino-pilosa. Caput, thorax et scutellum sparsim ac subtiliter punctulata; elytra punctis majoribus foveolatis et rugulis transversis ornata.

Length, 19–21, breadth (greatest), 10.5–11.5, mm. ♂ ♀.

Locality, Costa Rica: Turrialba, Schildt and Burgdorf, collectors; same locality, 5500 ft., C. H. Lankester, collector; Volcan de Irazu, Staudinger; and San Jose, Underwood, collector.

Paratype, U.S.N.M. Cat. No. 43321.

Anomala perakensis, n. sp.

A. chloronota Arrow proxime affinis. Oblongo-ovata, postice leviter ampliata, supra capite, thorace scutelloque olivaceo-viridis leviter aenescens, clipei margine anteriore thoracisque lateribus flavis, elytra obscurius olivacea lateribus flavomarginata, subtus cum pedibus flava leviter aenescens, abdomine cum pygidio antennisque fulvis; supra glabra, subtus cum pedibus et pygidii margine sparsim flavopilosa. Clipeus cum fronte sat fortiter confluenter, vertex et thoracis discus minus fortiter singulatim, thoracis latera confluenter punctata. Elytra dense confluenter punctata et transversim aciculata, lineis punctorum majorum 6–7 seriatis perspicuis. Pygidium et abdominis latera subtiliter confluenter punctata et transversim aciculata. Metasternum et femora intermedia dense strigosa et flavopilosa.

Length, 13, breadth, 7.5, mm. ♀ ♂.

Locality, Perak: Trong, W. L. Abbott, collector.

Type and paratype, U.S.N.M. Cat. No. 43322.

The shape of the aedeagus is very similar to that of *A. chloronota* Arrow (Faun. Brit. India, Col. lamell., part II, 1917, Pl. 2, Fig. 5), but the apex of each paramere is less rounded and somewhat toothed at the inner edge.

ANOMALA EBENINA Fairmaire

This is one of the most variable species of the genus, showing nearly all degrees of passing from black to yellow. As the species is very common in

the southern provinces of China, Yunnan and Tonkin, I could examine some hundred specimens and found that all these color varieties are individual and not limited to certain localities. It therefore seems useless to name these varieties and I only wish to show the passing from black to yellow on the various parts of the body.

Head: generally pure black, even in specimen yellow above; only one ♀ has 2 yellow spots on the vertex.

Thorax: (1) pure black, (2) black with metallic green reflections, (3) black with a narrow yellow border at the sides alone, (4) that border broadens before and behind the lateral groove, which at first is connected with the large discal spot, until this diminishes more and more, so that finally (5) the thorax is pure yellow.

Scutellum: is always black, even in the clearest specimen.

Elytra: (1) pure black or black with faint green lights, (2) black with a small yellow spot in the middle, (3) this spot increases to a pointed transverse yellow band, (4) this band extends to the base alone, so that the foremost half is yellow, the hind half black, or (5) it extends in the apical direction alone, so that the foremost half is black, the hind half yellow, (6) the yellow extends in longitudinal stripes, beginning from the lateral margin, so that the suture and hind border alone are black, or the base and shoulders alone are black, finally (7) the whole elytra are yellow.

Propygidium: (1) black, (2) black with a small yellow spot in the middle, (3) pure yellow.

Pygidium: (1) black, (2) black with two yellow spots on the disc, (3) these spots extend more and more until there remain only three small black spots, one at the apex, one in each anterior corner. I have not yet seen specimens of pure yellow color without these black spots.

Abdomen: generally pure black; rarely yellow spots occur at the sides of the sternites or in the middle of the penultimate sternite; the sterna (pro-meso- and metasternum) are always black.

Legs: mostly black; rarely the anterior border of the femora, the inner border of the anterior tibiae and a small spot on the hind trochanters are yellow.

Antennae: (1) black, (2) the stem yellow, (3) the club, except the darkened top, also yellow.

The shape of the aedeagus, Fig. 2, of this species is very peculiar. The paramera are very asymmetrical, the right short and fine, the left much prolonged, whip-like and rolled up like the proboscis of a Sphingid butterfly.

Anomala filigera, n. sp.

A. raui Ohaus proxime affinis. Oblongo-ovata, parum convexa, supra viridi-aenea densissime confluenter punctata, subnitida, thoracis lateribus, propygidii margine posteriore et pygidii lateribus flavis; subtus cum femoribus et antennis flava leviter viridi-aenescens, tibiis tarsisque viridi-aeneis; supra glabra, subtus cum pygidii apice sparsim flavopilosa. Clipeus trapezoidal angulis rotundatis et margine anguste elevato, sutura frontali recta.

Thorax lateribus solum anguste marginatus, sine foveolis lateralibus. Elytra nec sulcata nec punctato-seriata, margine laterali paulo incrassato. Pygidium nitidum dense arcuatim aciculatum, prope angulos anteriores leviter foveolatum. Abdomen et pectus dense confluenter punctata et aciculata. Tibiae graciles, anteriores bidentatae, intermediae et posticae medio paulo incrassatae et ante apicem constrictae, posteriorum calcar superior fortiter prolongatus, quam inferior duplo fere longior.

Length, 17.5–18, breadth, 10, mm. ♂.

Locality, Sikkim: Kurseong; Assam: Shillong, 5000 ft., May 10, 1928, L. B. Parker, collector.

Paratype, U.S.N.M. Cat. No. 43323.

The shape of the aedeagus, Fig. 3, seen from dorsal and right side, is very similar to that of *A. ebenina* Fairmaire. The paramera are very asymmetrical, the right as if crippled, the left much prolonged, whip-like and somewhat rolled up.

ANOMALA SEMICASTANEA Fairmaire

Fairmaire described this species in Ann. Soc. Ent. Belg., **32**: 21, 1888, from China: Kiangsi, and three years later in the same Annales redescribed it from Kiukiang, Kiangsi, as *A. castanipennis*. The species is also frequent in the province of Fokien (G. Siemssen, collector). The species is violet-blue, generally with green lights, only the elytra and abdomen are brownish-red. In the aedeagus, Fig. 4, the free symmetrical paramera bear at the top one sharp tooth. Specimens from Tonkin: Mts. Mauson (H. Fruhstorfer, collector) and Laokai (R. Vitalis de Salvaza, collector) are somewhat stouter than the typical form, above and beneath dark blue without any green lights, elytra and abdomen of a clear red. The aedeagus of these specimens is one-toothed as in the typical form. In other parts of China, especially in the southwestern provinces, but also in Shantung: Tsingtau, occur specimens which at first sight seem to be immature: above, the head and scutellum alone are violet-blue, while the thorax is as red as the elytra and abdomen; beneath, the sterna and legs are blue-violet or metallic green. In the aedeagus, Fig. 5, the paramera have two sharp teeth, one at the top, a second one at the outer side. This species, which also differs somewhat in the shape of the thorax and in the sculpture of the anal sternite, I call:

Anomala rufithorax, n. sp.

A. semicastanea Fairmaire proxime affinis. Oblongo-ovata, modice convexa, supra rubro-castanea capite et scutello solum violaceis, subtus capita, sternis pedibusque violaceis aut viridi-coeruleis aut viridi-aeneis; supra glabra nitida, subtus sparsim pilosa. Thorax ante medium dilatatus ibique foveolatus, lateribus inter dilatationem et angulos posteriores incurvis, angulis posticis paulo productis. Abdominis segmentum anale margine posteriore dense aciculatum, subopacum. Cetera sicut in *A. semicastanea*. Aedeagus, Fig. 5.

Length, 14–19, breadth, 7.5–10, mm. ♂ ♀.

Locality, China: Prov. Szechuen, Siao-lou, Se-pin-lu-tschan, Mupin;

Prov. Shantung, Kiau-tschou (in collection Ohaus). Prov. Szechuen, Mt. Omei, 4400 ft., Shin-kai-si, August, 1921, D. C. Graham, collector; south of Kuan-shien, July 5, 1924, Graham, collector; Ya-chou, May-June, 1928, Graham, collector; between Ya-chou and Mupin, June 23–26, 1929, 2000–5000 ft., Graham, collector; Suifu, June 25, Graham, collector; Prov. Nganhwei, Soo-chow, N. Gist Gee, collector (in collection U.S.N.M.).

Paratypes, U.S.N.M. Cat. No. 43324.

Lepadoretus subcostatus, n. sp.

L. griseosetosus Nonfried proxime affinis. Elongato-ovatus, modice convexus, castaneus, dense subtiliter confluenter punctulatus, subnitidus, supra et subtus pilis albidis brevibus appressis dense vestitus. Elytra subcostata, pilis in costulis alternatim condensalis et evanescentibus, in callis apicalibus longioribus erectis. Pygidium in disco fasciculo pilorum longiorum ornatum, inter discum et basin linea brevi longitudinali nuda, inter discum et apicem plaga triangulari fusca nuda instructum.

Length, 10–12.5, breadth, 5–6 mm. ♂ ♀.

Locality, Lower Burma: Rangoon (F. J. Meggitt, collector).

Type and paratypes, U.S.N.M. Cat. No. 43325.

The shape of the aedeagus, Fig. 6, is very characteristic for this species, being the only one in this group of very similar species, in which the joined paramera show an oval hole in the median line just before the apex.

ENTOMOLOGY.—*The genus* Myndus *Stal in North America (Homoptera Fulgoridae).*[1]

E. D. Ball, University of Arizona.

The members of this genus are usually small, fragile, more or less moth-like leaf hoppers without spines on the hind tibiae, and with the vertex long, carinate margined and narrowing anteriorly. The front is narrow above and greatly widened below where it meets the clypeus in an almost straight transverse suture. In general appearance they resemble species of *Cixius* and *Oliarus* but the hind tibiae without spines and the female abdomen terminating in typical pygofers and ovipositor instead of a large wax plate with reduced genitalia will at once separate them.

Van Duzee listed twelve species in his Catalog, three of which should probably be considered as varieties. He was in error in listing *delicatus* from "Fla"; it should have been North Carolina. Fowler in "Biologia" describes the genus *Haplaxius* with two species. The type *laevis* appears to be *Myndus pictifrons* of Stal and the other species (*frontalis*) to be equal to *sordidipennis Stal* which is probably a variety of *pictifrons* lacking the color on the elytra. *M. pictifrons* seems to be congeneric with *musivus* Germ., the European type of *Myndus*, thus

[1] Received August 5, 1933.

making *Haplaxius* a direct synonym of *Myndus*. Besides these Fowler described two new species of *Oliarus* that appear to belong to this genus. His *O. chiriquensis* by the shape of the vertex is certainly a *Myndus;* he does not show the legs but the type is a female and a glance at the pygofers will be enough to determine this point. His *O. insignior* is by the head and male genitalia another *Myndus* and by the size should be very distinct and easily recognized. Metcalf added one species. The writer is adding ten more and offering a provisional key to those available for study.

PROVISIONAL KEY TO THE AVAILABLE SPECIES

A The apical portion (at least) of elytra with definite markings, often an oblique pattern, stigmal cell often widened, more or less semi-circular, with the apical venation more or less modified to conform.

B A definite oblique band from the stigma to the anal angle, no transverse band on front (*catalina* excepted).

C Shining black with white apical spots.....1-*beameri* Ball

CC Not black.

D Front extremely broad at apex, the carinae margined with dark above.

E Clypeus smoky or black.....2-*mojavensis* Ball

EE Clypeus pale, a transverse band on the suture .....3-*catalinus* Ball

DD Front less widened below. Concolorous.

F A black saddle including the mesonotum....4-*yuccandus* Ball

FF Mesonotum saffron.....5-*nolinus* Ball

BB No definite oblique band on elytra. Front usually transversely banded.

G Face ornamented but not white with black bands at base and apex.

H Face with a broad (or double) black band below, a faint tawny one above.....6-*lunatus* Van D.

HH Face white with a scarlet triangle at apex....7-*rubidus* Ball

GG Face white with a black band above and below..8-*collinus* Ball

AA Apical portion of elytra concolorous (except occasionally in *pictifrons*) the stigmal cell rarely widened.

I Face transversely banded. *sordidipennis* Stal. *radicis.* Obst., *laevis* Fowl, *frontalis* Fowl., *delicatus* Van D. and *truncatus* Metc.[2] — 9-*pictifrons* Stal; 10-(————)

II Face concolorous

J Vertex normal, definitely narrowing anteriorly, species normally elongate.

K Species green or pale golden straw.

L Species green or greenish.

M Vertex long and narrow, more than twice longer than wide, no triangular genital projection.....11-*viridis* Ball

[2] All of these species have the two bands on front. It will take a special study with more material than is now available to determine the number of valid species involved, which is probably not more than two or three, of which *pictifrons* Stal is the oldest name and the rest are arranged in order of proposal.

MM Vertex broad, less than twice longer than broad, a definite genital projection in both sexes.....12-*viridicatus* Ball
LL Species straw color or golden.
N Species straw color.....13-*ovatus* Ball
NN Species golden.....14-*auratus* Ball
KK Species sordid or brownish (*pusillus* may be all pale)
O Species small, pale (southern).....15-*pusillus* Van D.
OO Species larger (over 1 m.m. wide) darker.
P Species brown, no dark spots on venter (Rocky Mts.) .....16-*impiger* Ball
PP Species pale, margins of venter with black spots (Pacific) .....17-*occidentalis* Van D.
JJ Species stout, vertex very broad and often not narrowing anteriorly.
Q Species sordid (Var. *enotatus* Van D.) or black with a light saddle .....18-*slossoni* Ball
QQ Species golden.....19-*fulvus* Osb.

Myndus mojavensis Ball n. sp.

Resembling *lunatus* in pattern, much larger and more definitely marked, with an angularly excavated pronotum and semicircular stigmal cell. White with dark lines against the carinae on front, vertex and mesonotum and a dark pattern at the apex of elytra. Length 4.5–5 mm.

Vertex definitely narrower at apex than in *lunatus;* front narrower at base, broader and more foliaceous at apex with a stout carina. Pronotum much longer than in *lunatus*, over half the length of the eye, deeply angularly emarginate posteriorly, while in that species it is not over one-third the length of eye, and shallowly roundingly emarginate. Elytra longer than in *lunatus*, the nervures heavily setigerous, punctured. The cubitus forking much farther back so that the cell thus formed is scarcely longer than wide, stigmal cell almost semi-circular. Male pygofers with a long slender median, brown, projection reaching to the apices of the white hammer-like plates—dorsal "hood" one-half longer than plates, its apex circular and entire.

Color, white above including front, dark smoky brown below including clypeus, the margins of abdominal segments white, front ivory, a pair of broad oblique black stripes inside the broadly elevated lateral margins above. Vertex with the disc mostly black, the lateral and base of median carinae broadly ivory. Pronotum ivory with dark brown areas behind the eyes, mesonotum with dark brown areas outside and similar stripes inside the broadly ivory lateral carinae. Elytra creamy white, an apical cloud, dark lines bordering the stigma and the ivory transverse nervures and three dark lines radiating from the base of the cloud.

Holotype ♀ allotype ♂ and 12 paratypes Mojave, Calif. June 15, 1909 and one male paratype from the same place July 1, 1931—all beaten with much difficulty by the writer from the tip "branches" of the Joshua trees (*Yucca brevifolia*) in the mountains to the north. A strikingly distinct species the writer has been trying to get time to describe for nearly a quarter of a century.

Myndus beameri Ball n. sp.

Resembling *mojavensis* with the carinae much less prominent. Front much shorter and broader, the clypeus short, tumid and lacking the foliaceous carinate margin above of that species. Elytra with the venation similar

to *mojavensis*. The cell formed by the fork of the cubitus four or more times as long as wide instead of wider than long, the nodal cell fully half longer than wide instead of semicircular as in that species.

Color, deep shining black above and below (sometimes fading out to a dark brown), an oblique dash on the stigma, two large areas in the outer apical cells, three small spots in the inner apicals and a spot at the apex of clavus ivory.

Holotype ♀ June 17 and three paratype males in June, Chiricahua Mts., Arizona. Two paratype males Huachuca Mts., June 14, 1928 (A. A. Nichol). Allotype ♂ and four pairs of paratypes, Santa Rita Mts., Arizona, July 17, 1932 taken by Dr. R. H. Beamer. Holotype and paratypes in author's collection; allotype and paratypes in Kan. Univ. collection; paratypes in U. S. Nat. Museum collection. This remarkably distinct species was taken on a young century plant by Dr. Beamer in whose honor it is named.

Myndus catalinus Ball n. sp.

Similar to *mojavensis*, smaller, elytra hyaline with dark margins and an extra apical cell. Length 4–4.5 mm. Vertex and front slightly narrower at union than in *mojavensis*, especially noticeable on the base of front. Elytra slightly narrower, the cells formed by the forking of radius and cubitus both very short, usually shorter than in *mojavensis*, the apical nervure arising from the apex of cubitus cell again forked forming an extra (eleventh) apical cell. Male terminal abdominal segment deeply excavated, over twice the depth of that in *mojavensis*, the short hammer-like plates scarcely exceeding the notch.

Color, vertex smoky or darker with the carinae light, front ivory, a pair of narrow lateral lines above and a dark crescent at apex, clypeus yellow, the tip smoky. Pronotum creamy white with a dark collar in front, mesonotum pale with two dark stripes (all dark in female). Elytra hyaline before the stigma with definite smoky margins, the longitudinal nervures white. The outer dark marginal line turning in before the stigma and expanding obliquely across the apical cells, another dark line arising back of the stigma and joining the first in the center, a line at right angles to this back to costal margin and about 5 dots on the nervures between the oblique stripes and the apex of clavus. Below, pale yellow.

Holotype ♀ Sabino Canyon near Tucson, Arizona, June 28, 1930, allotype ♂ Patagonia, Ariz. Sept. 20, 1930. Both examples were swept by the writer from vegetation at the foot of high rock faces.

Myndus nolinus Ball n. sp.

Resembling *mojavensis* in structure, pale saffron without black markings before the stigma. Length 3.4–4 mm.

Vertex much broader than in *mojavensis* with the lateral and median carinae only slightly elevated. As seen from the side the clypeus is much elevated above and angled with the lower half. The venation is similar to *mojavensis* with ten apicals. The cells at the forks of the radius and cubitus are rarely longer than wide.

Color, saffron yellow above and below, the mesonotum almost tawny, elytra hyaline before the stigma with the longitudinal nervures slightly embrowned, the claval suture and costa light. There is an oblique dash before the stigma, an oblique line arising at the apex of stigma and ending in

the ninth apical, the lines radiating from the center of this to the margin smoky brown. The nervures in the anal area are alternately ivory and dark.

Holotype ♀ allotype ♂ and seven paratypes, Williams, Ariz. July 13, 1929 and one ♀ paratype Tombstone, June 14, 1932; all taken by the writer sweeping under the margins of the clumps of bear grass (*Nolina*). The saffron color alone is quite distinctive.

Myndus yuccandus Ball n. sp.

Much smaller than *nolinus* with a still broader, blunter head. Saffron with the mesonotum and a semicolon on each elytron black. Length ♂ 3 mm.

Vertex broad almost parallel margined, slightly widening and almost conical where it joins the front without a carina. Front almost half as wide at base as at apex, where it is folicaceously expanded before joining the small and little inflated clypeus. Pronotum extremely long and only shallowly excavated posteriorly, almost parallel margined and as long as the width of the vertex. Elytra long and narrow, only slightly arcuated at base. The venation simple, the forks of radius and cubitus much longer than their width. Two apical nervures arising from the posterior margin of the cubitus cell. Apex of terminal segment of male roundingly produced over a triangular projection which is exposed only about its own width, plates broad and short with a broad obliquely rounding apex.

Color, face and below tawny or saffron unmarked, head and pronotum pale saffron or straw color, with two dark stripes on posterior portion of vertex. Mesonotum deep black with an ivory scutellar line on each side and a waxy depressed spot before the apex. Elytra subhyaline, the nervures saffron, a pair of large commas back to back against the scutellar angles and a pair of round dots beyond forming a pair of black semicolons. The first set of cross nervures white with more or less of dark margins, the second set dark with a dark cloud in the inner angles.

Holotype ♂ and one paratype male taken from *Yucca* at the Grand Canyon Bridge, Ariz., Aug. 30, 1930 by the writer. A strikingly distinct little species.

Myndus collinus Ball n. sp.

Resembling *sordidipennis*, slightly longer with a pair of dark stripes on the white mesonotal tablet and the second apical nervure dark. Length 5.5–6 mm.

Vertex as in *sordidipennis*, the front slightly broader and with the upper black markings decidedly oblique. Elytra longer and narrower, the outer anteapical longer and narrower than in that species and usually less definitely angled. Male pygofers with a smaller, narrower triangular projection and much broader and more evenly rounding plates than in *sordidipennis* where they are long and obliquely truncate. The lateral margins of the pygofers very slightly uniformly rounding while in *sordidipennis* they are acutely angled and usually black tipped.

Color of *sordidipennis* nearly, smoky brown, the face creamy with two black bands, the upper one consisting of two oblique dashes. Mesonotal tablet white with two black stripes adjacent to the median carina. Elytra milky subhyaline, the nervures smoky with dark stripes along the sutural margin to the middle, dark margins on nodal cell and the second apical dark,

a dark cloud in the inner angles emphasized on the nervures. These markings present in the males while in *sordidipennis* the male elytra are usually smoky subhyaline.

Holotype ♀ and allotype ♂, Fort Collins, Colo., July 7, 1898, and one paratype male July 2, 1898; all taken by the writer. This material was placed with *sordidipennis* until the striking difference in the shape of the pygofers was noted. When sorted on this character other differences were apparent.

Myndus rubidus Ball n. sp.

Resembling *collinus* in size and form but lighter and more definitely marked, face ivory white with a large scarlet triangle. Length 5–5.5 mm.

Vertex much narrower than in *sordidipennis* and its allies, the carinae as high and the vertex as narrow as in *catalinus*, the face longer and narrower than in either species. Elytra with the subcostaradial fork wider than its length before the nodal cell, nodal cell short and rounding, the tumid stigma occupying fully half its width.

Color, vertex creamy white, the high carinae broadly dark lined, face creamy or ivory white with a large scarlet triangle with its base on the apex of front. Pronotum pale, a dark inner circle extending out on the projection below, mesonotum dark brown, the central tablet lighter, variegated. Elytra hyaline, the nervures white, a narrow dark smoky band across the stigma to apex of clavus, emphasized on the longitudinal nervures but omitting the cross nervures, the radial fork all dark. A pale smoky band at apex emphasized on seventh apical and running in on the cross nervure. Below the legs are white with two triangular spots on the pectus shining black in sharp contrast. Tergum and venter dark, the margins light.

Holotype ♀ and two paratype females taken by the writer at Brownsville, Tex., Jan. 4, 1932. The scarlet triangle on the face alone will distinguish this pretty species.

Myndus viridicatus Ball n. sp.

Resembling *viridis*, slightly smaller, broader with a shorter vertex; bright vivid green. Length 4–5 mm.

Vertex definitely broader than *viridis*, less than twice as long as its basal width. Elytra slightly broader, the nodal cell longer, with the margin thickened equally throughout, about 2½ times as wide as the costal nervure. Female with the last ventral segment deeply triangularly emarginate, the apex of the notch with a roundingly triangular projection. Male pygofers compressed, their lower margin produced into two dark margined triangles, from the bottom of the notch between arises a compressed projection about twice the length of the notch and bearing an elongate keel on the back; plates parallel margined as far as the median projection then broadened into elongate oblique apices clothed with long hairs.

Color, deep green in life, the eyes partly darkened, below paler green, the elytra with a trace of tawny towards the apex.

Holotype ♀ allotype ♂ and 4 ♀ paratypes Huachuca Mts. Aug. 2, 1931, one ♀ paratype Santa Catalina Mts. Aug. 15, 1931, all collected in Arizona by the writer.

Myndus ovatus Ball n. sp.

Resembling *viridicatus* but a still broader vertex and slightly longer elytra with a broad stigma. Green. Length 4.5–5 mm.

Vertex broader in front and more nearly parallel than in *viridicatus*, much broader and shorter than in *viridis*. Elytra long and slender with long apicals, the nodal cell oval with a nervure at right angles to costa in the anterior portion before which the area is thickened, beyond this nervure the margin is thickened in a curved stigma which occupies nearly half of the cell. Female segment with the base of the triangle broadly rounded without a projection, male pygofers as in *viridicatus*, the lower margins projecting slightly but only slightly sinuate. The median projection with a wider keel, the plates very slender for the length of the projection then terminating in an almost round expansion four times the width of the basal portion.

Holotype ♀ July 14, 1894, allotype ♂ June 28, 1894, both taken by the writer at Ames, Iowa. These were included as paratypes of *viridis* when that species was described, but in studying the material in comparison with *viridicatus* it was discovered that there were three distinct green species, one with triangular genital projections in both sexes (*viridicatus*), the other two lacking them but easily separated by the wide vertex and round plates in *ovatus* as against a long narrow vertex and long narrow plates in *viridis*. The holotype of *viridis* is hereby fixed on a ♀ taken by the writer at Grand Junction, Colo. July 28, 1900, and now in the author's collection.

Myndus auratus Ball n. sp.

Resembling *occidentalis* slightly longer and more slender. Golden and straw color without the dark markings. Length 5–5.5 mm.

Vertex and front similar to *occidentalis*, the elytra longer and narrower, the outer anteapical cell definitely wider than the nodal with the inner margin angled at the cross nervure to the medius, the medius forked at this point but the outer fork continuing the line of the nervure. The nodal cell long and narrow, truncate in front and rounding to costa behind, the stigma 2½ to 3 times the width of the costa.

Female segment less deeply notched than in *occidentalis*, the male pygofers with the acute projections of that species reduced to sinuations, the styles with the inner margins nearly straight and the outer ones broadly expanded apically instead of the reverse as in *occidentalis*.

Color, golden and creamy with a trace of green on the venter, elytra golden subhyaline, the nervures concolorous, no black markings on the abdominal segments as in *occidentalis*.

Holotype ♀ allotype ♂ and six paratypes taken by the writer, Bonita Canyon, Chiricahua Mts., Ariz., July 6, 1930.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

GEOLOGICAL SOCIETY

500TH MEETING

The 500th meeting of the Society, which was also the 40th anniversary of its founding, was held in the Assembly Hall of the Cosmos Club, February 22, 1933, President C. N. FENNER presiding. The program was contributed entirely by charter members.

Program: WHITMAN CROSS.—*Reminiscences concerning the founding of the Society.*

Discussed by Messrs. KEITH and FENNER.

T. W. STANTON: *The evolution of the geologic map of the United States.*—The first geologic map of the United States is that of William Maclure published in the Transactions of the American Philosophical Society in 1809. A second edition, which was exhibited, appeared in 1817. It covers the country east of the Great Plains and follows the classification of Werner, dividing the rocks into Primitive, Transition, Floetz or Secondary, and Alluvial, with a special tint for the Triassic, which was called Old Red Sandstone.

A more modern stratigraphic classification was used by James Hall in 1843 in a map which covered the area from Hudson River to the Mississippi and as far south as the southern boundary of Virginia. Lyell's Travels in North America, published in 1845, was accompanied by a similar map.

Between 1853 and 1869 there appeared maps of North America by Edward Hitchcock and by Jules Marcou, and of the United States in whole or in part by Marcou, H. D. Rogers, Hall and Lesley, and Logan and Hall.

A geologic map of the United States by C. H. Hitchcock and W. P. Blake accompanied the report of the ninth Census published in 1872. A revised edition of this map, which is on the scale of 1 to 7,115,000, or about 110 miles to the inch, was included in Walker's Physical Atlas in 1874.

Hitchcock prepared a large wall map of the United States on a scale of 20 miles to the inch which was published by Bien in 1881.

The first general geologic map of the whole country issued by the United States Geological Survey was compiled by W J McGee with the assistance of C. H. Hitchcock, on a scale of 1 to 7,115,000 and published in 1884 with the Fifth Annual Report. It shows large blank areas in the western States. Hitchcock's map published in 1887 in the Transactions of the American Institute of Mining Engineers is a revision of McGee's map and said to have been printed from the same stones, but its appearance is different because the uncolored areas are smaller and the scheme of coloring is changed to that adopted by the International Congress at Berlin in 1885.

McGee's map of 1893 published in the Fourteenth Annual Report of the Geological Survey is a revision of his map of 1884 with many blanks filled and some changes in classification.

In preparation for the meeting of the International Geological Congress in Mexico in 1906 the United States Geological Survey, the Geological Survey of Canada, and the Instituto Geologico of Mexico cooperated in the compilation of a geologic map of North America on the scale of 1 to 5,000,000. The work was done under the supervision of Bailey Willis and an edition of 1,500 copies was printed at the expense of the Mexican Government before the meeting of the Congress. A second edition of this map, in the compilation of which Willis was aided by George W. Stose, bears the date 1911 and was issued with Professional Paper 71. It shows many changes, especially in the classification of the pre-Cambrian.

A new geologic map of the United States, on the scale of 1 to 2,500,000, or 40 miles to the inch, now in press, will be published by the Geological Survey before the Washington meeting of the International Geological Congress next summer. The eastern half and a color proof of the northwest quarter of this map were exhibited. (*Author's abstract.*)

N. H. DARTON: *Zuñi Salt Lake.*—This lake is in a large deep crater in the Cretaceous plains, about 75 miles south of Gallup, New Mexico. The crater is believed to be the product of a volcanic explosion for it has volcanic

cinder cones in its center and its rim is capped by a low ridge of rock fragments mostly volcanic but including limestone containing fossils from Carboniferous strata 800 feet or more below the surface. The crater is about a mile in diameter, nearly 200 feet deep and has walls of horizontal Upper Cretaceous sandstone capped in part by a thin sheet of lava of moderate antiquity. The shallow saline lake covering part of its bottom has furnished salt for Indians and others for many centuries. The two cinder cones near the center are about 150 feet high, and one of them has a deep crater with a small saline pond in its bottom. The rim of ejected fragmental material which covers a zone of moderate width, consists largely of scoria and fragments of lava but also much sand and scattered masses of the fossiliferous limestone above mentioned. It is known from observations in adjoining areas that some distance underground the Cretaceous sandstone is underlain by the red beds of the Chinlee and Moenkopi formations, at least 700 feet thick, which in turn are underlain by Kaibab limestone which furnished the fossiliferous fragments.

It is evident from these observations that the crater is the product of deep-seated explosion in advance of an upwelling of lava which produced the two cinder cones. Its history is similar to that of many other explosion craters[1] in this and other countries including the Afton Crater in the plains west of El Paso, various craters in the Pinacate region of northern Sonora, Mexico, and some of the numerous "Xalapagos" in central Mexico. Also a crater recently discovered in the San Bernardino lava field, 30 miles northeast of Douglas, Arizona. These great craters show the competency of explosion in connection with volcanic activity to produce such a crater as Crater Mound, (so-called "Meteor Crater") southwest of Winslow, Arizona. (*Author's abstract.*)

Discussed by MR. BUTTS.

ARTHUR KEITH: *Major structures and intrusions in New England.*—Granites are especially prominent in southern Maine, New Hampshire, and central Massachusetts, forming part of the long succession of granite bodies along the southeastern part of the Appalachian system.

Long arms marked by granite instrusions project from the principal granite region, westward to Montreal, northward through New Brunswick, and eastward through Nova Scotia. These appear to radiate from a center under the Gulf of Maine. As a whole the granites are limited by a boundary running west of north from eastern Connecticut to Montreal, P. Q., and thence N. 70° E. to the Bay of Chaleur in New Brunswick, southerly to the Bay of Fundy, and finally easterly across Nova Scotia. The apex of this wedge cuts entirely across the Appalachian System through Montreal, a relation found nowhere else, and again nearly crosses it in the Gaspé region of northeastern Quebec.

The major folds and faults of the region are continuous for hundreds of miles with parallel trends. In northern Vermont the structure trends change nearly 60°, from west of north to northeast forming the Vermont salient. This change is accompanied by a great excess of northwestward movement evidenced by thrust faults and strong folds.

An axis drawn southeastward from the Montreal granite projection and through the principal granite concentration is almost identical in position with the structural cross axis passing through the Vermont salient. At this cross axis, common to intrusions and structures, a notable arrangement of

[1] DARTON, N. H., Explosion Craters, Sci. Mo., November, 1916.

sedimentary systems and pitching folds is found. For instance, Silurian rocks nowhere cross this axis although they come close to the axis in five parallel synclines which cover the entire folded belt from the St. Lawrence River to the Gulf of Maine. The same sort of thing is true for the other Paleozoic systems although they are somewhat less widespread. It is clear that the major folds pitch away from the cross axis so that the systems of the Paleozoic and pre-Cambrian deepen and widen away from it, especially to the northeast.

The intrusives are nearly all massive biotite granite, with small amounts of diorite, gabbro, syenite, and rarer holocrystalline rocks. They are treated here, not as petrographic problems, but as masses which influence structure. They range in size from plugs a fourth of a mile in diameter, through stocks of a few miles, and up to batholiths 140 miles long and 20 miles wide. The smaller masses have rather rounded outlines, but the large ones are very irregular.

Contact metamorphism is very slight, and there is no dynamic metamorphism except in a few bodies of pre-Cambrian and pre-Devonian granite.

The granitic rocks cut the youngest formations with which they are in contact, usually Ordivician, Silurian, and Devonian, both sediments and volcanics. In three regions the granites also cut Pennsylvanian strata; these are the Narragansett basin in Rhode Island, the Worcester basin in Massachusetts, and the Portland basin in southern Maine. Other areas may perhaps be found in the little explored regions of New Brunswick.

The relations of major uplift along the cross axis, of concentrated thrust to the northwest along the same axis, of concentration of intrusions in same belt, of great excess advance of magmas on the same axis, of the Pennsylvanian age of many granites, of probable similar age for most of the others, of closing Pennsylvanian age for the folds and thrusts, of visible force where intrusions have forced aside the sediments, makes a complete and coherent structural system. It is so reasonable and free from exceptions that serious consideration must be given to the theory that the intrusions were a direct cause of the structures. From this conclusion must be omitted some pre-Devonian granites in eastern Maine and eastern Massachusetts, and perhaps some post-Devonian granites in New Brunswick, as well as various pre-Cambrian granites. (*Author's abstract.*)

Discussed by Messrs. BUTTS, STOSE, and FENNER.

WILMOT H. BRADLEY, *Secretary*.

SCIENTIFIC NOTES AND NEWS

Prepared by Science Service

NOTES

U. S. Public Health Service studies encephalitis.—The outbreak of encephalitis lethargica centering around St. Louis has commanded much attention from the U. S. Public Health Service. A staff of investigators, under Dr. JAMES P. LEAKE, has been on the ground since the earlier stages of the epidemic. Surgeon-General HUGH S. CUMMING and Assistant Surgeon-General R. C. WILLIAMS have made visits to the area and are in constant touch with developments.

The efforts of the Public Health Service workers are bent primarily toward obtaining a better understanding of the epidemiology of the disease.

In addition to compiling a complete record of case histories, they are following all promising leads which may help toward a knowledge of the mode of transmission of encephalitis. They have procured a number of Rhesus monkeys for inoculation experiments, which have yielded results which though still somewhat equivocal are at least suggestive.

Mosquitoes as encephalitis vectors.—Strong evidence that the virus of one type of encephalitis may be carried by mosquitoes has been obtained by Maj. JAMES S. SIMMONS, Lt.-Col. RAYMOND A. KELSER and Maj. VIRGIL H. CORNELL. Their preliminary report was published in *Science* for September 15. Rabbits were used as experimental animals, and *Aedes egypti* as the carriers. The virus was of the herpes encephalitis type, probably not identical with the disease of the St. Louis outbreak. Three strains of virus were used, one of them having originated from a human case. Mosquitoes that had fed on infected rabbits were allowed to feed on uninfected animals, a large proportion of which died, some of them developing paralysis, and some showing also typical lesions in brain and spinal cord. It was further proved possible to transmit the infection by implanting brain tissue from the mosquito-infected rabbits into healthy animals.

Maj. SIMMONS and Maj. CORNELL went to St. Louis on September 4 to study the possible connection between mosquitoes and the present epidemic of encephalitis lethargica there. They were accompanied by Sgt. JESSE F. RHOADS and Sgt. GEORGE F. LUITPOLD, M.C., U.S.A., who are expert "mosquito men."

Dutch elm disease a stowaway.—Dutch elm disease, which federal and state authorities are fighting in the area around New York Harbor, came in as a stowaway in elm logs shipped from Europe for use in the manufacture of furniture veneer. Conclusive evidence to this effect was presented by R. KENT BEATTIE of the U. S. Department of Agriculture before a shade tree conference held in New York City on September 8. Although the logs are known to the trade as "Carpathian elm," they appear to come principally from central and southern France. Evidences of the disease, culturable infections of the fungus, *Graphium ulmi*, and both of the species of carrier beetles, *Scolytus scolytus* and *S. multistriatus*, have been found on logs landed at Atlantic seaports. Importers have cooperated willingly in an effort to stop fresh entries of infected beetles. On September 15 a hearing on the Dutch elm disease situation was held at the U. S. National Museum.

Weather Bureau has a busy day.—Labor Day, Sept. 4, was decreed by Secretary of Agriculture WALLACE as a complete holiday: all workers in the Department were instructed to stay away from their offices, which were to be locked up tight from Saturday noon until Tuesday morning. Two tropical storms chose just that day to strike the coasts of Florida and southwestern Texas, respectively, and the force at the Washington office of the Weather Bureau had one of the busiest working days in its history. According to C. L. MITCHELL, the simultaneous landfall of two tropical storms was unprecedented in the history of the Weather Bureau.

Radio talks.—The following radio addresses were sent out from Washington on the network of the Columbia Broadcasting System, under the auspices of Science Service: "Millionth of a Second," by Prof. J. W. BEAMS, University of Virginia; "The Poetry of the Rocks," by Dr. R. S. BASSLER, U. S. National Museum; "How Animals Spend the Winter," by AUSTIN H. CLARK, U. S. National Museum.

Office of National Parks, Buildings and Reservations.—The former National Park Service, organized as a bureau of the Department of the Interior, has now been merged in a new Office of National Parks, Buildings and Reservations. The new Office administers several classes of Government property not included in the responsibilities of the National Park Service, notably the parks and public areas in the District of Columbia.

The blazing-colored Cedar Breaks area in Utah was made a national monument by proclamation of President Roosevelt signed August 25, making a total of 51 national monuments now under the jurisdiction of the Office of National Parks, Buildings, and Reservations. The monument contains approximately 5,760 acres and was formerly a part of the Dixie National Forest.

Pinnacles National Monument, California, a reservation administered by the National Park Service, has been enlarged through considerable extension of its northeastern, northwestern and southern boundaries. A proclamation legalizing the addition was signed recently by President Roosevelt. The addition comprises 5,001.78 acres, making the total area of the monument now 9,908.39 acres, more than double its former size.

A study of the nesting grounds of the white pelican, recently made for the Office of National Parks, Buildings and Reservations by BEN H. THOMPSON, indicates a population of from 20,000 to 25,000 of these birds still surviving in the United States proper, plus an unknown but probably smaller number in Canada. There are now only seven known large nesting colonies, whereas there were formerly at least seventy.

Studies of diseases in game birds.—Progress in studies of upland-game-bird diseases was reported at the American Veterinary Medical Association annual meeting held in Chicago from August 14 to 18, by Dr. J. E. SHILLINGER of the Bureau of Biological Survey, U. S. Department of Agriculture. Losses in some species of game birds in recent years have more than offset reproduction, said Dr. SHILLINGER, and through disease studies the Biological Survey is aiding in the propagation of quail, pheasants, grouse, and other birds on game farms. Presenting a paper of which Dr. L. C. MORLEY, also of the Biological Survey, is joint author, Dr. SHILLINGER discussed the variety of test birds used in bureau experiments in transmitting ulcerative enteritis in quail, grouse, and other game birds. This disease, he reported, often wipes out a large part of the stock on game-bird farms, young birds sometimes dying within 48 hours after contact with a virulent strain of the infectious agent. The causative organism, he said, has not yet been grown in the laboratory in pure cultures, but postmortems indicate that it is a toxin producer as well as a cause of ulcer formation in the digestive tract. The paper described a back-yard laboratory maintained by Dr. MORLEY at his home in Richmond, Va. Here Dr. MORLEY keeps watch of nesting birds, eggs during incubation, young birds in an electric brooder, and their growth to maturity in a developing pen.

The Oil-Pollution Menace.—As a member of the Interdepartmental Committee on Oil Pollution of Navigable Waters, F. C. LINCOLN, of the Bureau of Biological Survey, is representing the Department of Agriculture in a study being made of measures to deal with the oil-pollution menace on the high seas. Other members represent the Division of Western European Affairs, Department of State, which has sponsored the committee; the Bureau of the Public Health Service, Department of the Treasury; Office of

the Chief of Engineers, Department of War; Bureau of Construction and Repair, Department of the Navy; the Geological Survey, Department of the Interior; and the Bureau of Fisheries, Department of Commerce. The committee held its first meeting on August 16, at the State Department.

Department of Terrestrial Magnetism.—Dr. E. H. BRAMHALL, research associate at the Massachusetts Institute of Technology, and Dr. R. J. STEPHENSON of the University of Chicago, are spending two weeks at the Department of Terrestrial Magnetism for training in magnetic observations preparatory to field work with the Byrd Antarctic Expedition II. Dr. THOS. C. POULTER, in charge of the scientific work of this Expedition, also spent a few days at the Department discussing the proposed magnetic and cosmic-ray work to be undertaken on the Expedition.

P. G. LEDIG of the Department of Terrestrial Magnetism has made a short inland trip in Brazil obtaining determinations of the magnetic elements at Catalao, Bella Vista, and Goyaz in the state of Goyaz. He is now in Santos where he will make a series of cosmic-ray observations for Professor COMPTON before sailing for New York September 13.

Cooperative work in China under the direction of Mr. F. C. BROWN, a former observer with the Department of Terrestrial Magnetism, now connected with the American Church Mission at Hankow, China, assisted by Dr. C. T. KWEI of the Department of Physics at the Central China College at Wuchang, has been carried on during the summer in spite of civil warfare necessitating a change of itinerary. The results obtained by these observers doing part-time work as occasion offers are extremely valuable in the study of secular variation in that part of the world.

Seismograph beats telegraph.—On Friday morning, August 25, a heavy earthquake took place in the region of Chengtu in interior China. Its epicenter was given an approximate location by seismologists of the U. S. Coast and Geodetic Survey on the basis of data collected and reported telegraphically to Science Service by the Jesuit Seismological Association and numerous official and university seismological observatories. At that time the statement was made that "considerable damage and loss of life was probably inflicted on the region." Five days later, belated cable reports confirmed the information thus first obtained directly from seismological sources.

Child labor.—Prohibition of the employment of minors under 16 years of age under the National Recovery Act has given renewed emphasis to national interest in child-labor problems. The Children's Bureau has recently published, under the title *Employed boys and girls in Rochester and Utica, New York*, the latest of a series of several studies undertaken to find out the kinds of work open to boys and girls and the effect of age and education upon their occupations and the stability of their employment. The previous studies of this series were made in Newark and Paterson, N. J., and in Milwaukee, Wis. All these inquiries were made before the commencement of the general industrial depression that began in 1929, so that the facts obtained indicate the extent and nature of child employment under relatively prosperous business conditions. ALICE CHANNING, who, with HARRIET A. BYRNE, directed the field work, wrote the report of the study in Rochester and Utica, which was under the general supervision of ELLEN NATHALIE MATTHEWS, formerly director of the industrial division of the Children's Bureau.

News Briefs

The setting of commercial standards, until now an activity of the Commerical Standards Group of the National Bureau of Standards, has been relinquished to a private organization, the American Standards Association, by order of Secretary of Commerce Roper.

Dr. Thomas V. Moore, professor of psychology at the Catholic University of America, has published an important contribution to the study of mental disease in the University's "Studies in Psychology and Psychiatry." Dr. Moore makes use of a new technique in multiple correlations to analyze the occurrence of five distinguishable syndromes in the manic-depressive and dementia praecox psychoses.

George Washington University announces the following additions to its faculty: Dr. Edward Bright Vedder as professor of experimental medicine and executive officer of the department of pathology and experimental medicine; Dr. Donald B. Young as professor of zoology; and Dr. William John Cooper, formerly U. S. Commissioner of Education, as professor of education.

Sheets from the famous Mutis herbarium, housed at the Madrid Botanic Garden since the Colombian revolution of 1816, are now yielding many species new to science, though it is well over a century since they were collected. The renewed study of this collection was stimulated last year by a visit of Ellsworth P. Killip, of the U. S. National Museum, to Madrid. Duplicates have been sent to the Herbarium here, while Dr. Arturo Caballero carries on examinations in Madrid.

"Depression grave robbing" is the term applied to archaeological pothunting which amateurs, spurred by the hope of small monetary gains to relieve their distress, have been carrying on in Indian mounds, southwestern village sites, and other scientifically valuable spots all over the country. He appealed to property owners to prevent such vandalism, and to the diggers themselves to spare irreplaceable relics of American prehistory, whose scientific value is incomparably greater than the small cash returns they might possibly yield.

"Heavy water," containing larger than average ratios of the higher isotopes of oxygen and of hydrogen isotope 2, has been found to occur naturally in the water of crystallization in salts from Great Salt Lake and the Dead Sea, by Dr. E. B. Washburn of the U. S. Bureau of Standards. This natural "heavy water" from the Dead Sea was two parts per million heavier than ordinary water; that from Great Salt Lake three parts per million heavier.

A mosquito survey of the entire United States has been undertaken by the Medical Corps of the U. S. Army, in cooperation with the Civil Conservation Corps.

Birds, as well as man and the forests, are benefiting by the Federal unemployment relief program. Three camps of the Civilian Conservation Corps are improving refuges established and maintained by the Federal Government for the protection of birds. One of these, the Blackwater Migratory Bird Refuge, near Cambridge, Md., is a breeding ground for black ducks and blue-winged teal. Mallards and pintails also concentrate on the Blackwater

marshes during the migration season, and many shorebirds find sanctuary there. The other two refuges now being improved by the Conservation Corps are used by the birds principally during migration and in the winter season—Swanquarter Migratory Bird Refuge, in North Carolina, and St. Marks Migratory Bird Refuge, in Florida.

The extension to the Experiment Building at the Department of Terrestrial Magnetism, the Carnegie Institution of Washington, has now been completed and the installation of the two-meter Van de Graaf electrostatic generator is progressing rapidly.

Personal Items

Maj. H. A. Nisely of the Ordinance Department, U. S. Army, spoke on the mechanization of military forces before the Chicago meeting of the Society of Automotive Engineers, on August 28.

Dr. F. A. Moss of George Washington University addressed the Society of Automotive Engineers at their Chicago meeting, on August 31. He discussed a number of psychological problems connected with motor car operation.

Dr. J. W. Turrentine of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, reported on progress in building up American potash production, before the meeting of the American Chemical Society in Chicago.

Dr. M. X. Sullivan and Dr. W. C. Hess of Georgetown University presented a paper before the Chicago meeting of the American Chemical Society, on a correlation between cystine deficiency in the tissues and the incidence of arthritis. They stated that injection of colloidal sulfur brought about an improvement in the condition of arthritis patients.

Dr. Paul H. Furfey, of the Catholic University of America, presented a paper before the Chicago meeting of the American Psychological Association.

C. B. Watts, senior astronomer of the U. S. Naval Observatory, who will have charge of the World Longitude operations in October-November, left the Observatory for San Diego, Calif., on September 5. J. E. Willis will join Mr. Watts on September 25.

Commander Guggenheim of the French Navy passed through Washington en route to San Diego, where he will collaborate with the Naval Observatory's party in the prosecution of some special work desired by the French government.

Dr. Thomas B. Nolan of the U. S. Geological Survey was awarded the Spendiaroff prize of the International Geological Congress in recognition of his studies in the western mining districts of United States.